THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

WIRELESS PROGRESS IN WARTIME.

WHILST engineering entered into each and every phase of military activity, there were certain branches of engineering, notably wireless telegraphy and telephony, which were vastly developed by the war. The imperative necessity for maintaining communication at the front at all times, and under all conditions, resulted in astonishing progress being made in wireless practice. It has been said that these branches of engineering were further advanced during four years of war, than they might have been under normal conditions in, perhaps, 30 years. The *Electrical World* recently printed a series of articles, some of which have been abstracted in the REVIEW, on the development of wireless work and methods of signalling in the U.S. Signal Corps, during America's participation in the war.

A very notable factor in wireless development has been the vacuum valve. These valves, which are most versatile in their adaptability, have become an important element in this branch of engineering, and the device has been perfected and standardised to a wonderful degree. The capabilities of this apparatus have made it possible to accomplish what was formerly impracticable in wireless engineering. At the outbreak of war the three-electrode vacuum valve was a laboratory device rather than an army instrument, and it must be admitted that incredible wonders have been achieved in transforming the delicate valve into a standardised military apparatus, so that it could be manufactured, shipped, and utilised in large numbers under war conditions, and without much dependence upon highly specialised skill.

The remarkable service that wireless direction-finding apparatus has rendered during the war was made possible by the substitution for the vertical-mast antenna of a simple loop or set of loops capable of being rotated about a vertical central axis. By this means it becomes theoretically possible to orient any particular set of incoming electromagnetic waves to which the loop is attuned. It may surprise some readers to learn that a simple vertical frame about 2·7 sq. m. in area, and containing in, say, 25 turns, an aggregate of 67·5 sq. m., will enable an operator, when equipped with suitable receiving apparatus, to hear on the eastern coast of America the high-powered wireless stations of Europe. Within certain limits of precision the true bearings of these stations may also be determined by means of such a frame.

Two valuable applications of the loop direction-finder are to the establishment of the map position in bad weather of both air- and sea-craft. The simple loop is merely a direction finder, but, by the use of a pancake loop, the dissymmetry of structure with respect to the inner and outer ends may be utilised in such a way that the apparatus becomes a wireless compass. It should ultimately become almost impossible for a navigator to lose his map position, either in the air or on the sea, if equipped with suitable wireless direction-finding apparatus, and with beacon land stations at work.

As illustrative of the unusual and difficult problems that presented themselves for solution, mention may be made of the designing of a two-way wireless set for use in tanks. This important branch of the service was entirely dependent upon wireless for reliable communication, a number of other systems having been tried without success. A tank is a very near approach to Faraday's shield, or completely electromagnetic wave-proof, metallically-enclosed receptacle. The continuous-wave sets designed to meet the exigencies of the situation are very interesting, and involve the use of the vacuum valve, both in transmitting and in receiving. Transmission may be carried on during the progress of the tank over the roughest ground, but, on account of the

tremendous noise of the mechanism, reception is extremely difficult, except when the tank is stationary.

In conclusion, it should be pointed out that the success of the work of development of wireless engineering and apparatus is largely attributable to the whole-hearted co-operation of various electrical firms and engineers. Nor must the officers and men of the Army Signal Corps, who won widespread approval, and deserve unstinted praise for the way in which their work was done, be forgotten. They were called upon to plan and install, under many hardships, large telegraph and telephone systems, and they maintained communication often under conditions that would be regarded as hopelessly impossible from peace-time standpoints.

Watch the Meters.

It is, perhaps, not sufficiently realised, especially by the smaller electricity supply undertakings, that the question of metering the energy supplied to consumers is one of the most crucial factors in the whole business. Every unit not properly metered is a dead loss in money to the undertaking. An all-round lack of accuracy on the meters would thus seriously affect the revenue. Further, it has to be recognised that this is not a case where inaccuracy in one direction can be set off against inaccuracy in another. Assuming that a meter is correct to start with, the tendency is for the meter to go slow, seeing that this is a natural result of increase in friction. The tendency to develop over-registration is rarely met with, and is, in fact, practically impossible on many types of meters.

It may be taken, therefore, that the faults developing on meters are all on the side of the consumer, and against the undertaking. One very general fault is for a meter to get into the condition of not starting on a low load. With the low-wattage lamps now in use, a corresponding demand is made on the meter for efficiency in this direction. It is a most common fault for meters not to start with one lamp, and this with thousands of consumers would become, in the course of a year, quite a serious matter. Further, by the nature of the case, this fault operates on high-priced units, namely, the lighting supply. As a case in point, some years ago a large London undertaking found that, although it was developing rapidly, there was not a proportionate advance in the revenue, and it was decided to inaugurate a thorough-going meter department. Within the next year or so following the overhauling and accurate adjustment of the meters, they brought in an extra revenue far and away outstripping the expenses incurred. One of the new steps taken in this case was that the meters were changed about every three years, instead of being left out on circuit almost indefinitely. In some small undertakings, even at the present day, meters are installed and left without attention for years. There has, in fact, been a case in which the meters in an undertaking were allowed to go wrong so far as to attract attention through a noticeable and wholesale falling off in the revenue. Of course, if the station meters are kept in order, and the total of the consumers' meters checked thereby, after making allowances for distribution and other losses, a check is readily obtained. The item of "units unaccounted for" reflects the efficiency of the meters, and in some cases one may guess from this where there is a top-hole meter department. Perhaps the fact of the meters being looked upon as merely part of the mechanical apparatus coming under the control of the engineer, has caused their direct relation to the revenue to be overlooked by the management. Now the whole question is one of crucial importance to supply undertakings. Curiously, in Mr. Seabrook's otherwise excellent book on the "Management of Public Electric Supply Undertakings," there is a lack of stress in emphasising this point. The subject of testing and repairing meters is dismissed with the statement that "the Meter Department will require well-equipped testing and repair rooms." Whatever may be conveyed *implicitly* by this, to drive in *some* truths requires a sledge hammer.

Lighting Efficiency.

In our "Correspondence" columns to-day, Mr. F. W. Willcox raises some interesting points relating to illumination. With regard to the first—the necessity of photometric tests—it is, of course, admitted that to judge of the technical efficiency of an illuminating system by the eye alone is apt to be most misleading; in this respect, owing to its extraordinary adaptability, the eye as a measuring instrument is altogether out of court. On the other hand, it should never be forgotten that the illumination is provided solely for the *use* of the eye, and therefore the eye is entitled to express an opinion—a very decided and weighty opinion—on the utility of the illumination. This fact was emphasised by Mr. A. P. Trotter in his presidential address to the Illuminating Engineering Society, over a year ago, when he went so far as to say: "The eye only is the judge" of the final result. Hence, though in the case of Mr. H. G. Solomon's installation at Pusey House Chapel we should certainly have preferred to include photometric tests in our article, had they been available, we are not prepared to go so far as Mr. Willcox, and say that the power expended per square foot, in order to produce results satisfactory to the eye, is a valueless item of information. As our illustrations showed, the result was satisfactory to the camera; but whilst a photograph will indicate approximately the degree of uniformity of illumination obtained, it is admittedly useless as a criterion of the optical utility of the result. We relied, therefore, upon the fact that the illumination proved satisfactory to all concerned, and that glare, of course, could not possibly occur under the conditions described (facing east).

We seize this opportunity to lament the fact that many instances of lighting in public halls, and churches, could be cited where the methods of illumination adopted—whether by gas or electricity—are literally atrocious. Bare, unshielded mantles or m.f. lamps project their dazzling rays into the eyes of the audience, and there is no escape from them. Even in the large lecture theatre of a well-known college in London this is the case. Nothing, apparently, can be done except to urge our readers, when they meet with such atrocities, to take steps to bring the matter to the notice of the guilty parties.

Mr. Willcox endorses our judgment on the lighting of the theatre at the Institution of Civil Engineers, and suggests a remedy; a simple and, we believe, an effective plan, wholly in keeping with the design of the handsome ceiling, would be to suspend a powerful semi-indirect fitting in the centre of the dome, somewhat below the level of the plane ceiling, so as to illuminate the latter as well as the seating space. Then one would no longer feel as though immured in a pit, with a sort of Mahomet's coffin floating over one's head, surrounded by a luminous gap. The monotonous absence of "light and shade," and the lack of contrast, at the living level, produce a feeling of depression.

Municipalisation in Berlin.

The question of municipalisation in Berlin has now taken a new course in the light of the proposals referred to in the Electrical Review for April 18th. Since the taking over in 1913 of the Berlin supply works of the Berlin Electricity Works Co., the municipalisation of the works is declared to have so far yielded the city no "fiscal advantages," whilst the citizens and the industrial consumers have been faced with the disadvantage of having to pay an extraordinary increase in the charges for energy. Undeterred by these unsatisfactory results, the authorities now have under consideration the question of municipalising the transport undertakings in Berlin, under the auspices of the Berlin Public Utilities Union—a combination of the local authorities of Greater Berlin. The first to be taken in hand is the Grand Berlin Tramways Co., whose undertaking was to have been purchased as a going concern at the price of 150 per cent.—according to an agreement entered into a few years ago. It is now suggested, however, that the agreement should be repudiated, or that the new revision of fares, which are subject to approval or disapproval by the local authorities, should be so arranged that instead of the increases devolving upon the passengers, the company should be compelled to bear the additional working expenses, for which recoupment is desired by way of the proposed higher fares, so that the directors might be induced voluntarily to abandon the undertaking! Truly, nationalisation and municipalisation in Germany are proceeding, on paper, at all events, from bad to worse. Scrap-iron terms seem to be the principle aimed at, and only a short step separates this stage from that of complete confiscation.

S.A. ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS.

The third annual Convention of the Association of Municipal Electrical Engineers of the Union of South Africa was held at Port Elizabeth from February 10th to 15th, 1919, and was well supported by the various municipal electrical undertakings of the Union.

The Convention was opened by the Mayor of Port Elizabeth according the Association a hearty welcome to the City, after which the annual general meeting took place.

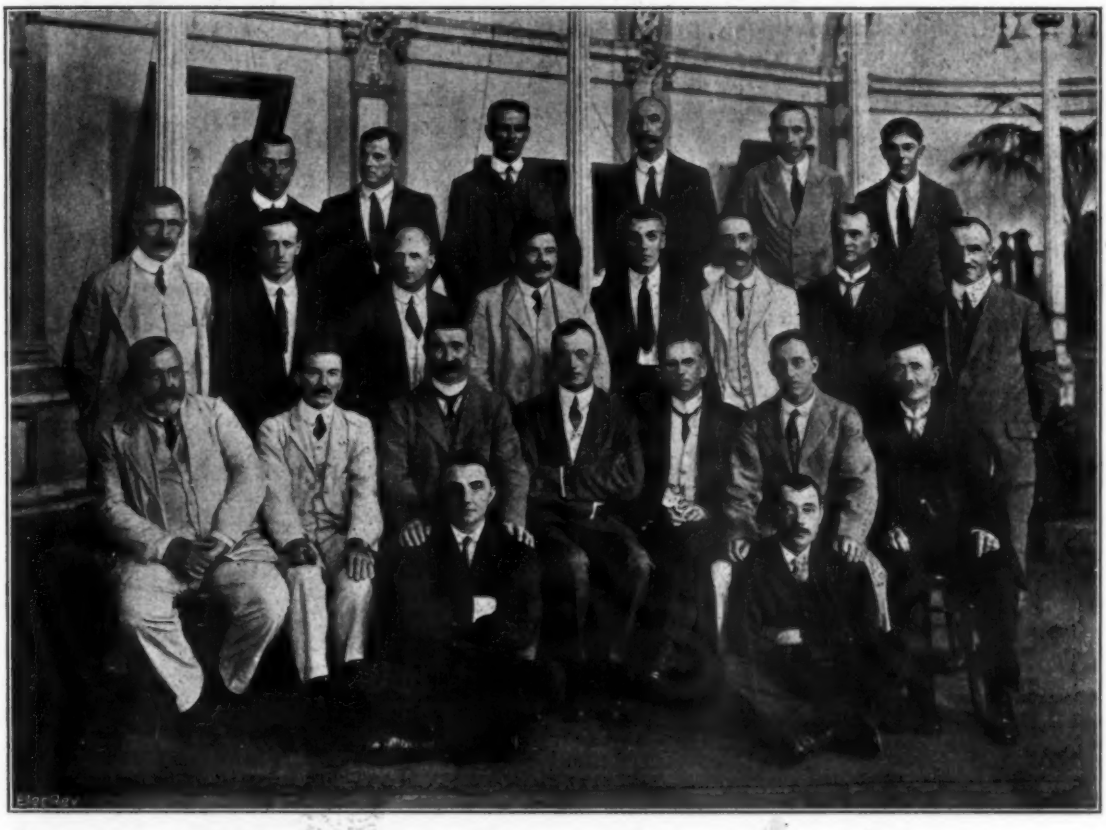
Mr. B. Sankey (City Electrical Engineer of Port Elizabeth) was elected President of the Association, and Mr. T. C. Wolley-Dod (City Electrical Engineer, Pretoria) was elected Vice-President, with Col. Dobson, D.S.O. (General Manager Electrical Departments, Johannesburg), and Mr. John Roberts (Borough Electrical Engineer, Durban), as Past-Presidents.

visits were paid to the power station, and the boot works of Edworks, Ltd.

On the following day, discussion was invited on the Presidential Address, which, dealing as it did with many matters of interest, was warmly applauded, and elicited some very useful points from the many speakers.

A report on "Proposed Wiring Rules" was then submitted by a Committee, consisting of Messrs. Sankey, Stewart and Wolley-Dod, but as they had not completed their investigations, it was decided to re-elect them, so that a final draft might be submitted at an early date.

In the afternoon a motion of Mr. John Roberts (Durban) was read on the inclusion of other municipal officials in the Association, which was left for members to consider and express their opinion on at the next Convention.



W. A. Hodge, Winburg. A. E. Val Davies, Capetown. T. Jagger, Ladysmith. Councillor Fairclough, Ladysmith. R. D. Coulthard, Oudtshoorn. G. Mercier, Bethel.

Councillor Thomson, His Worship the Mayor, Bloemfontein. P. H. Newcombe, Aliwal North. H. Brittle, Cradock. F. W. Mills, S.A. Railways. J. Mordy Lambe, East London. J. Vowles, Kingwilliamstown. Councillor De Jager, Oudtshoorn. J. Younger, Krugersdorp.

Councillor Crawford, Bloemfontein. A. S. Munro, Pietermaritzburg, (Member of Council). G. A. Stewart, Bloemfontein, (Member of Council). B. Sankey, Port Elizabeth, (President). E. Poole, Durban, (Hon Sec. and Treas.). W. Bellad-Ellis, Queenstown, (Member of Council). Councillor Doull, Pietermaritzburg.

C. J. Everett, Johannesburg. T. Millar, Harrismith.

Members and Delegates at the Port Elizabeth Convention.—February 10th—15th. 1919.

The elections for Members of the Council from the various Provinces were as follows:—

Messrs. W. Bellad-Ellis (Queenstown), G. A. Stewart (Bloemfontein), A. S. Munro (Pietermaritzburg), and E. T. Price (Johannesburg).

Mr. E. Poole (Durban) was again elected as hon. secretary and treasurer.

The valedictory address by the retiring President, Mr. John Roberts (Durban), was next read, after which the newly elected President, Mr. B. Sankey (Port Elizabeth), took the chair, and delivered his Presidential Address.

After the meeting, the Association was entertained to lunch by his Worship the Mayor, and in the afternoon

A special report was then presented by the Hon. Secretary and Treasurer, Mr. E. Poole (Durban), on Municipal Statistical Returns, in which an appeal was made for all returns to be on a similar basis; owing to the lengthy nature of the report, a Committee, consisting of Messrs. Roberts, Munro, Lambe, Davies, and Poole, was constituted to go into the matter, and draw up suitable forms for submission at a later date.

On the Wednesday a visit was paid to the Bulk River Waterworks of the municipality, the party numbering about 40.

On Thursday the party journeyed to Uitenhage, where they were officially received by the Mayor, after which a paper by Mr. G. H. Swingler (Cape Town) was read on

"The Registration of Electrical Contractors," and a warm discussion took place, in which the principle was approved of, and a Committee, consisting of Messrs. Swingler, Stewart, Dobson, Jagger, and the President (*ex-officio*) was appointed further to consider it and report. An adjournment was then made for lunch, by kind invitation of the Mayor, after which a visit was paid to the power station and railway workshops. The party then returned to Port Elizabeth, and in the evening the annual dinner of the Association took place.

On Friday a very interesting paper was read by Mr. C. J. Everett (Johannesburg) and discussed, on "Local Manufacture from S.A. Products," after which visits were paid to other local works.

The next Convention will take place at Pretoria.

BALANCING THE SUSPENDED COIL OF A MARINE GALVANOMETER.

By J. RYMER-JONES.

In the case of a sensitive moving-coil galvanometer, not only must the means provided on the coil itself for equilibrating the weight on both sides of the taut-wire suspension, and also for equalising the weight of the back and front of the coil, be capable of very fine adjustment, but, in order to test the degree of equilibrium attained during the process of balancing, the galvanometer is generally mounted on a platform which can be so manipulated as to subject the instrument to movements sufficiently resembling, for the purpose required, the pitching and rolling of a ship at sea. Furthermore, to expedite the process of balancing, there must be some method which can show the amount and direction of the adjustment necessary to compensate for any observed displacement of the spot from the instrument's zero, under a pitch or roll of a definite angle as indicated by a clinometer mounted on the platform.

The method hitherto employed consists in securing the galvanometer at one end, and a lamp, with its lens and graduated scale, at the other end of a stout board provided with a roller, in the form of a segment of a circle, secured to the underside of the board near the scale end; and, if desired, another also near the galvanometer end. Sometimes two handles project from the galvanometer end of the board for raising that end in order to represent a pitching movement of the ship; and the rollers beneath the board are to facilitate turning it over to one side or the other, through a considerable angle, and so produce on the suspended coil the effect of a ship's rolling motion.

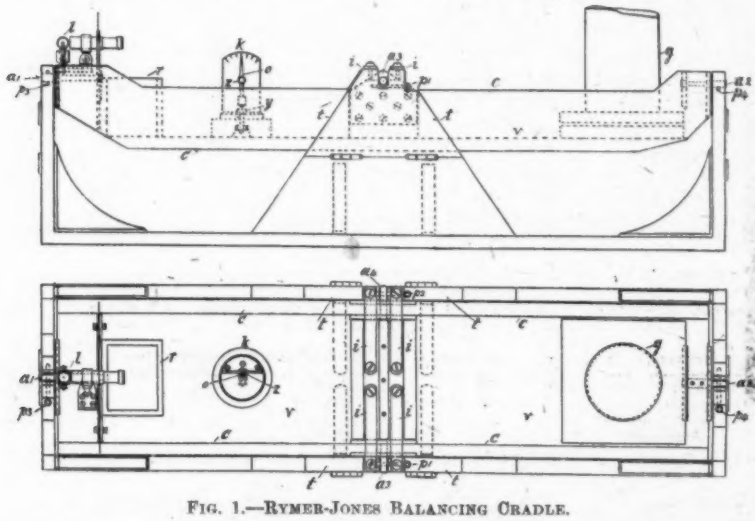


Fig. 1.—Rymer-Jones Balancing Cradle.

In both these movements the adjustment required (if any) for improving the balance is roughly indicated by the displacement of the spot of light, reflected on to the scale from the mirror, to one or the other side of the instrument's zero position, according as the one side or the other, or as the back or front of the coil, is the heavier; but the inexpert find it difficult to obtain a perfect balance quickly with the uncertain indications furnished by the above-mentioned board, and with the means of adjustment hitherto provided on the coil.

The improved platform here described for measuring any want of equilibrium in the galvanometer coil, with a view to perfecting its balance, is serviceable for any suspended coil, but it has been designed more especially to facilitate balancing a coil fitted with the balancing wires described in Patent Specification No. 108,649/1917 (Rymer-Jones), entitled "Improvements in or Relating to Galvanometers."*

It consists of a shallow trough (*c*) fig. 1, whose bottom is formed by a thick board (*v*) made additionally strong by stout sides and end boards. These end boards, and also the middle portion of the two sides, rise several inches above the board, in order that the axle rods (a_1 and a_2) at the ends of the trough, and also the axle rods (a_3 and a_4) at the middle, may be sufficiently high above the plank to keep the centre of gravity of the moving portion well below the axis on which the trough (*c*) turns, for the sake of stability.

The ends of the trough can be easily moved up or down by hand through any desired angle, up to 20°, on pin bearings (p_1 and p_2), placed midway along the trough's length, in order to subject the galvanometer (*g*), which is mounted near one end, to the disturbing effect brought about by a pitching movement of the ship. In this case these stout pins (p_1 and p_2), on which the axle ends a_3 and a_4 respectively turn, are inserted, as shown in fig. 1, while the pins p_3 and p_4 are *out*, to permit of the longitudinal axle ends (a_1 and a_2) passing freely upwards or downwards in a vertical slot.

To subject the galvanometer to a movement representing the ship's roll, pins p_3 and p_4 are first inserted, and p_1 and p_2 then removed, so that the axle ends (a_1 and a_2) can turn on their pins (p_3 and p_4), while the axle ends a_3 and a_4 are free to move upwards or downwards. This is rendered possible by first removing the four metal straps (*i*), and letting the upper part (*t*) of the side support, which is hinged, hang down out of the way and thus allow the *nearer* side of the trough to turn outwards on its bearings (p_3 and p_4) when the bottom of the trough is moved outwards with the hand, to represent a rolling motion. The upper part of the back support can be similarly hinged, but it is not necessary that the trough be movable in both directions, because any want of balance, as shown by the ship's rolling, is equally evident in one direction as in the other; in fact, it is desirable, in order to avoid confusion when interpreting the meaning of the displacement of the spot of light, to move the hanging part of the trough in only one and the same direction *always*. This applies also when testing the balance under a pitching movement, as will be explained later on.

The scale, with its electric light (*l*) and battery (*r*), serves as a convenient counterpoise to the weight at the galvanometer end, which is intentionally made rather the heavier, so that the platform will automatically return to its normal horizontal position of rest when free to do so. It, consequently, only requires a gentle pressure of the hand to tilt the trough and instrument through the desired angle.

The trough is fitted with a clinometer (*k*), capable of being turned round on its pivot (*y*), so as to be serviceable in two positions, at right angles to each other, and having a scale graduated up to (say) 20°, and its index-hand and sleeve (*o*) is movable, by friction, on the circular axle *z* to which the pendulum is attached, so as to be adjustable to the scale's zero whenever the platform is not quite horizontal when in a position of rest.

The displacement of the spot of light from zero on the galvanometer scale indicates the amount of correction to be

* See The Electrical Review, December 6th, 1918, p. 585.

applied by the balancing wires carried by the galvanometer coil frame in order to perfect the equilibrium—see Specification No. 108,649/1917, already referred to.

To obtain the data for readjusting the galvanometer's coil balance:—

If when the screw-threaded wire (b_2) provided for producing equilibrium between the back and front of the coil is turned through one complete circle a roll of 20° displaces the spot of light, say, 40 scale divisions to the *right* of zero, this will furnish a datum for future rebalancing between the back and front—*e.g.*, a quarter turn of b_2 in the *reverse* direction will in this case exactly compensate for an error indicated by a displacement from zero of 10 divisions to the right, provided that the platform is always turned through the same angle 20°.

Similarly, if when the other screw-threaded wire (b_1) provided for producing equilibrium between the two *sides* of the coil, is turned through one complete circle a pitching movement of 20° displaces the spot of light, say, 24 divisions to the right of zero; this will afford a datum for future rebalancing between the two sides—*e.g.*, a quarter turn of l_1 in the *reverse* direction will compensate for an error of six divisions to the same side of zero, provided that the platform be always moved through the same angle (20°).

As one end of each of the adjusting wires is filed flat, it is quite easy to judge when the wire has been turned through a right angle, or even a quarter of that angle.

What very greatly facilitates rebalancing is the important fact that since in the Rymer-Jones pattern of galvanometer, with which we are dealing, the adjusting wires b_1 and b_2 both pass *through the central line of suspension*, as well as at right angles to each other, they are quite independent of each other in respect of their effect on the coil's balance. Consequently, any want of equilibrium, be it under a pitching or a rolling movement of the ship, can be quickly corrected, the one immediately after the other, at one operation, with the assistance of the two tables constructed on the basis of the above data.

The balancing process is greatly simplified if the balancing board be always turned in the same direction (say), *outwards*, to represent a *roll*, and the galvanometer end be *raised* to represent a pitching movement, and invariably through 20°, as was done when constructing the two tables.

Moreover, it prevents confusion if the operator always notes which is (say) the *heavier*. Thus:—"Back 10, Right 4," would mean that the *back* of the coil is too heavy as indicated by 10 divisions, and the right *side* 4 divisions too heavy. Referring these values 10 and 4 to their respective Tables, it will be seen what adjustments are necessary to compensate for both of these inequalities in weight. For example:—In this case the back end of wire b_2 is to be turned through $\frac{1}{8}$th of a complete circle in the direction of the hands of a watch to make the *front* heavier by that amount, and also the right-hand end of the wire (b_1) is to be turned through $\frac{4}{24}$th, or $\frac{1}{6}$th, of a complete circle, *i.e.*, 60°, in the direction of the hand of a watch to make the left-side heavier by that amount.

The trough and stand are made in two separate parts, and are, therefore, easily portable; but, if so desired, the whole cradle, with its galvanometer and fittings—as shown in fig. 1—can be permanently installed on the testing-room table, and the testing-keys and other apparatus arranged around it, so that the sliding frame, in which the galvanometer coil is suspended, has simply to be withdrawn to make any alteration in the two wire adjustments required from time to time, and then replaced in the galvanometer.

The facts that these two wires (b_1 and b_2) have quite independent effects on the coil's balance, and that both adjustments can be quickly effected, the one immediately after the other, render what has hitherto been a very risky, difficult and confusing process—not lightly undertaken even by those who can justly consider themselves experts—a simple, expeditious and reliable operation by the method above described.

The galvanometer scale and the electric-light fittings are provided with special adjustments to ensure a good spot of light.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The Supplementary Estimates provided by the Provincial Legislature of Ontario for the Hydro-Electric Power Commission, for capital expenditure during the present fiscal year provides for amounts, allotted as follows:—

Niagara system	$1,000,000
Severn system	100,000
Eugenia Falls system	50,000
Muskoka system	200,000
Port Arthur and Thunder Bay system ...	2,500,000
Woodell's Falls system	1,000
St. Lawrence system	150,000
Rideau system	500,000
Miscellaneous	75,000
Central Ontario system	1,000,000
Nipissing system	175,000
Queenston — Chippewa development at Niagara Falls	6,000,000
Expenditure on account of Province ...	195,000
Total...	$11,946,000

This Commission recently gained a victory at the polls in the City of Hamilton, where a by-law was submitted to the people regarding a proposed "hydro-radial" electric railway, which is to run from Toronto through Hamilton to St. Catherines. In 1916 this by-law was voted on by all the municipalities, through which it is intended the railway shall pass, but although at that time Toronto, and practically all the other places, voted strongly in favour of such a line being constructed and operated by the Commission, Hamilton, which has a population of about 100,000, together with one or two very small places, voted against it, and the whole question was postponed till the cessation of hostilities.

Sir Adam Beck has stated that the line will now be built as soon as possible.

It will be noted in the foregoing table that a sum of $2,500,000 is appropriated for capital expenditure during the year on the Port Arthur and Thunder Bay district. This is for the development of water power to serve the "twin cities" Port Arthur and Fort William; the power house will be about 75 miles from these towns, and about 50,000 H.P. will be developed and transmitted at 110,000 volts, on a wooden pole line. This part of Ontario is rich in minerals, particularly iron and copper, while the two cities named are the ports at the western end of Lake Superior, where all the great shipments of grain which are sent east by way of the Great Lakes are loaded on to the vessels.

There is much discussion going on in this country at present on the question of making engineering a closed profession; the Engineering Institute of Canada, formerly the Canadian Society of Civil Engineers, is asking various questions of its members in regard to this matter.

The electrical engineers, particularly in Toronto (most of whom, owing largely to the fact that no branch of the I.E.E. exists in Canada, are members of the local sections of the American Institute of Electrical Engineers) are desirous of forming a purely Canadian Electrical Institute, and this matter was discussed at a meeting held recently in Toronto; the question is also coming up whether there should not be some purely Canadian Institute or Society which would embrace all engineers—civil, mechanical, electrical, &c.

A general description of the great electric-steel plant at Ashbridge's Bay, Toronto, which went by the name of British Forgings, Ltd., has recently been published in the *Canadian Engineer*, permission for the publication of the details having just been accorded by the chairman of the Imperial Munitions Board.

The site of these works, which is all reclaimed land, has an area of 127·65 acres; there are 5,000 ft. of dockage facilities along the ship channel—a body of water 400 ft. wide and 7,000 ft. long ending in a turning basin 1,000 ft. sq., having a depth of 24 ft. at mean low water.

There are also about 7 miles of railway sidings. Before reclamation the ground was waste marsh land; it has been filled by hydraulic dredging to a depth of about 10 ft.

Owing to the unstable nature of the ground, all building

column piers and foundations for heavy plant are supported on piles spaced 3 ft. apart and driven to a depth of about 30 ft.

The melting house where the electric furnaces are is 608 ft. long × 75 ft. clear span in 27 bays of steel frame construction.

There are ten 6-ton three-phase Héroult furnaces; each furnace has its own 1,500-K.V.A., 13,000/100-volt, three-phase, 25-cycle, water-cooled, oil-insulated transformer; the electrodes are controlled by Thury automatic regulators, although hand regulation is provided for as well.

During the war this plant melted steel scrap—borings and turnings from munition factories—into steel billets for making shells, and the plant of the British Forgings, Ltd., includes also a large forging shop equipped with six 500-ton hydraulic presses.

Altogether this entire works took about 20,000 H.P. to operate it, power being obtained from the Toronto Hydro-Electric system, which purchases in bulk from the Hydro-Electric Power Commission of Ontario; at present the works are for sale, and are being largely advertised in Canadian and American journals.

THE FIELD OF THE ELECTRICAL CONTRACTOR.

By DONALD SMEATON MUNRO.

In these days of the settlement of frontiers, it should not be impossible to define a just boundary between the spheres of the electrical contractor and of the manufacturer with his selling agencies and factors.

This is an old grievance, for it is a long time since the contracting frontier was violated by the wholesale men. At times a better feeling prevailed, but there are ominous signs of a renewal of hostilities.

If the contractor be merely an injurious middleman, there is no more to be said. Contractors, however, may claim that they did great service not only when the foundations of the electrical industry were being laid, but in building up its structure. Most of them are men of experience, and many have had excellent technical training. This great body constitutes an ideal selling agency, in local and daily touch with the needs and fancies of the purchasing public. Yet if some of the wholesale people had their way, the contractor's domain would be reduced slice by slice until its occupants became a group of petty wiremen struggling for a livelihood with the inferior class of plumbers, ironmongers *et hoc genus omne*. Were this policy to continue, the final result would be an unexpected disaster to the wholesale trade. It is a poor invasion which cannot find some justification for its high-handed proceedings, and it may not be irrelevant to consider a few of the pleas advanced.

1. Messrs. Manu. Factors, Ltd. (symbol here adopted to economise space) find that their accounts are more surely and quickly met by certain large consumers than by the average contractor.

The reply to this is, that the financial struggle of the contractor is mainly due to the very invasion which this article seeks to stem. You cannot annex the richest fields without impoverishing those who lose them. To a certain extent, however, contractors finance Manu. Factors, Ltd., because many consumers do not pay for their installations until very long after the contractor has paid for the goods.

2. Messrs. Manu. Factors, Ltd., think to save all, or part, of the contractors' profit margin. It would be easy to show that this hope is a fallacy. It is, however, unfair to contractors, who hold stocks, employ skilled labour, and do good work for their discounts, and their extinction in any branch would result in a vast increase of selling cost and much less selling efficiency. No one is likely to work so hard as the man whose capital is at stake.

3. Some contractors are supposed to favour cheap foreign goods. If this were so in the old days, it will not be so in future because of the healthy change in public feeling about home manufactures—unless the contractors are driven to buy goods made abroad for the purpose of repelling the trespasses of Manu. Factors, Ltd. The contractor has to live by his local reputation, and his selection of articles to sell is a protection to the consumer against the plausible tongue of the casual commercial traveller. It was the foreign manufacturer and his local agents, however, who began the invasion complained of.

4. Messrs. Manu. Factors, Ltd., go to the expense of sending out commercial travellers—ostensibly to the trade. If any one contractor does not buy the goods of Messrs. Manu. Factors, Ltd., why should not the wholesale traveller sell direct to the important customers of that contractor? The traveller thirsts for immediate results.

This is a case of heads M.F. wins; tails contractor loses. No contractor can buy everybody's goods all the time. Neither can a manu. factor expect to receive orders from all the contractors of a district, but should reasonably be content with his share of business gradually acquired. If this principle of item (4) were to prevail, then in a town or district of ten contractors on whom ten manu. factors were calling, each contractor might have nine hostile "wholesale" travellers competing with him.

The only way to meet this is for all the contractors to combine against a manu. factor who pursues this policy. If Messrs. Manu. Factors, Ltd., desire to cultivate the retail trade no one can hinder them; but it would be unreasonable for them to expect any assistance from contractors.

In many cases there would be no harvest for the more grasping manu. factor to reap if contractors had not prepared the soil and sown the seed.

5. Messrs. Manu. Factors, Ltd., find it useful to establish local agencies. They may expend much money on these, on handsome showrooms, extensive stocks, and shop window show. Why should they not sell to the public so long as they charge retail prices? Against this it may be urged that they would not so readily find it profitable to do so if they were not subsidised by the orders from contractors. This gives them the additional advantage that, in the course of the legitimate wholesale business, they become acquainted with the names and needs of the retail customers of their proper clients.

6. Messrs. Manu. Factors, Ltd., have graciously agreed to sell only to people who have an electrical staff. Even if this arrangement were rigidly adhered to by the local agencies, its value is reduced to the vanishing point by the adopted definition of the phrase "an electrical staff." There are now few works or warehouses or clubs or hotels, &c., which do not have at least an elevator attendant or fuse-replacing porter who (when suitably pressed) will call himself an electrician. Manu. Factors, who do not wish to play the game, consider this quite sufficient for their purpose. Thus whenever contractors develop a town sufficiently they may have to carry on their trade against the competition of hosts of wholesale (?) travellers. First their profits are cut down, then all their good customers are lost, then Manu. Factors, Ltd., are very angry because a contractor does not send them good orders and pay promptly. When the weaker contractors are reduced to a helpless condition they may be financed by Manu. Factors, Ltd., and become really a cover for the more shady transactions, permitting the wholesale practically to carry on an extensive retail trade.

These latter points apply specially to the agencies for foreign goods.

To meet the questions raised by No. 6 the contractors should press unitedly for a fairer definition of an electrical staff. What is really wanted is to exclude the consumer from traffic with Messrs.

Manu. Factors, Ltd. This is done in nearly all other respectable trades; why not in the electrical industry? And a large consumer should not be bribed to become a nominal contractor merely to secure trade terms for his own requirements.

7. Not only every plumber, but every ironmonger, optician, store, and fancy goods shop, is sedulously cultivated by the electrical travellers of Messrs. Manu. Factors, Ltd., lest there should yet remain a small field for the business of the retail electrican.

In view of the modern growth of the multiple department business it is not so easy to suggest a remedy for this. A remedy can be found, however, if a sense of fair dealing prevail.

It would not be difficult to name further points of conflict, but those given may suffice. The electrical contractors, maintaining useful local businesses with their own capital, skill, and personal effort, are like the infantry in the line. They are essential to the successful advance of the electrical industry. There is little wisdom in turning all the heavy ordnance, tanks, and aeroplanes of the electrical army into instruments for the decimation of their own infantry.

The desire of the author of this article is to see a united industry with all sections working together, each in its own sphere, for the triumphant progress of applied electricity.

WIRELESS ARTILLERY-FIRE CONTROL.

The most important and extensive use of wireless apparatus by the Army during the war was for directing artillery fire from airplanes. Capt. G. F. Gray and Lieut. J. W. Reed, of the U.S.A. Signal Corps, contribute an interesting article on this subject to the *Electrical World*.

When the U.S. entered the war the type of transmitting set chosen for the major part of the work for this service used an alternator mounted on the wing of the airplane and driven by an air fan, the wireless apparatus being of the synchronous gap type. This fan maintained fairly constant speed independent of the velocity of the airplane. The receiving apparatus used a double tuned circuit and a crystal detector. The communication provided was entirely one-way, the airplane carrying a transmitting set only and the battery station having only a receiving set. The circuit used is of the synchronous spark type, and is shown in detail in fig. 1.

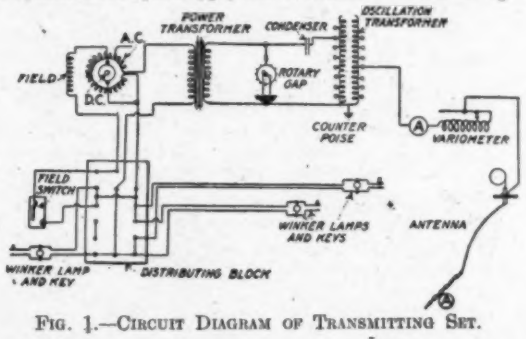


Fig. 1.—Circuit Diagram of Transmitting Set.

The generator is an inductor alternator, self-excited. The Westinghouse design has the following characteristics: Diameter, 6¼ in. (15.9 cm.); length of frame, 5¼ in. (13.6 cm.); weight, 11 lb. (4.9 kg.); output, 335 volt-amp. at 94 volts, 900 cycles, and 60 per cent. power factor; excitation, 0.4 amp. at 45 volts; speed, 4,500 r.p.m.

A particular requirement in designing this generator was that it should always build up when the field switch was closed. It was found that occasionally in shutting down the set the condenser discharged back and destroyed the residual magnetisation of the machine. The comparatively low field voltage also led to occasional failures to build up due to brush resistance. The use of higher field voltage, a damper winding around the field poles, and a change from the simple A.C. winding shown in fig. 2 (left) to the split winding shown in detail in fig. 2 (right), which prevents the demagnetisation of the field mentioned above, entirely eliminated the failure to build up.

The wireless apparatus, with the exception of the antenna variometer, is mounted in the stream-line casing of the generator. The detail development work and the production of this material were handled principally by the International Radio Telegraph Co., and the resulting extremely simple and ingenious design is due in great measure to its chief engineer, Mr. F. H. Kroger.

The construction provides for a number of spark wheels, giving the following spark frequencies: 1,800, 1,275, 900, 600, and 450. Nine wave lengths are provided for, and by varying the coupling it is possible to reduce the output current in several steps to a minimum of approximately one-fourth of the maximum. Under normal conditions the current in the antenna is approximately 2 amp.

The stream-line casing, which encloses the wireless apparatus and provides the necessary stream-line shape for the generator mounted in the air stream, is particularly notable as an example of the possibilities of "duck micarta." It is 16 in. (40.6 cm.) long, 6¼ in. (15.9 cm.) in diameter at its open end, has walls 1/16-in. (1.5 mm.) thick, and is not only an insulator, but is stronger and lighter than an equivalent aluminium casing. The surfaces are given two coats of baking varnish to prevent absorption of moisture or surface leakage.

The antenna variometer is used for tuning the antenna to the proper wave length (the antenna ammeter is mounted in

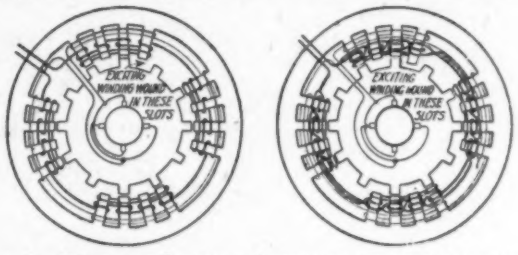


Fig. 2.—Wiring of Inductor Alternator as originally made (left); Method of Preventing Demagnetisation of Field (right).

the same case), and is a simple helix of copper wire wound on a bakelite tube and provided with a suitable trolley for short-circuiting more or less of the inductance. This device and the keys, antenna reel and field switch are the only parts of the apparatus that must be mounted within reach of the operator.

The air fan which supplies the power for driving the generator has been considerably developed. The speed of an airplane is variable, and a fixed-blade air fan varies its speed almost in direct proportion. Since the frequency of the alternator determines the note of the spark, and as this note is depended on to enable the receiving operator to read the signals through very serious interference, there was extreme need for a constant-speed air fan. In the more successful types of regulating air fans the principle of operation is to vary the pitch of the blades by means of the movement of weighted arms, which tend to move in response to centrifugal force, and are restrained by springs, the resultant of the two opposing forces determining the angle of the fan blades with the line of flight, and consequently the ratio of air speed to speed of rotation. The weight of this set is 28 lb. (12.7 kg.).

The antenna system on an airplane generally consists of a trailing wire having a maximum length of about 300 ft. (90 m.), the "earth" connection being furnished by the metal parts of the machine, which are all bonded together.

The antenna reel has a simple centrifugal governor which limits the speed at which the antenna pays out and prevents the loss of the antenna due to carelessness. It also is provided with a removable bobbin, so that a spare antenna may be carried on an extra bobbin and installed if needed.

The floor insulator through which the antenna wire passes, and at which the high-voltage connection to the wireless apparatus is made, is either made entirely of moulded material or of micarta tubing having a suitable flange moulded in place. The importance of careful design in this insulator will be appreciated when it is understood that the high-frequency potential in this set may reach 30,000 volts.

The weight used at the end of the antenna wire consists of a number of lead "beads" ½ in. (1.27 cm.) in diameter, in order to permit of a new antenna being installed with the airplane in flight, the new weight being dropped through the opening in the fairlead.

The antenna wire itself is a braided cable made up of 16 strands No. 30 B. & S. copper, and having an average breaking strength of 60 lb. (27 kg.).

There are three keys for each set, of flame-proof construction and having very heavy knobs and levers with fairly stiff springs, since they must be used by men wearing heavy gloves, and include a small incandescent lamp connected in parallel with the contacts. If the set is in working order, this lamp glows when the key is not depressed. In addition, the lamp serves to indicate to the pilot when the observer is transmitting and *vice versa*, since all lamps wink when any key is closed. The various circuits are wired through a moulded compound distributing box, and a toggle-joint switch is used for the field circuit.

The receiving set is generally installed in the neighbourhood of its artillery battery, with which it is connected by wire telephone. In this exposed position it would often be undesirable to supply charged storage batteries (hence the use of vacuum-tube detectors and amplifiers was impracticable), and the set was designed to use crystal detectors, galena or silicon being generally specified. The circuit used is shown in fig. 3. The buzzer is so connected as to excite the antenna

circuit. This reacts on the calibrated secondary, so that the operator can adjust his set to listen for a signal of predetermined wave length without the use of a separate wave meter at each receiving station.

The antenna must be light, inconspicuous, easily erected in a short time, and adaptable to a variety of surroundings and local conditions. In general the design used is a 60-deg. "V" composed of two wires 100 ft. (30 m.) long, and mounted approximately 20 ft. (6 m.) from the ground. When trees or buildings are not available masts are required. These are made of spruce or pine wood, and the sections are joined

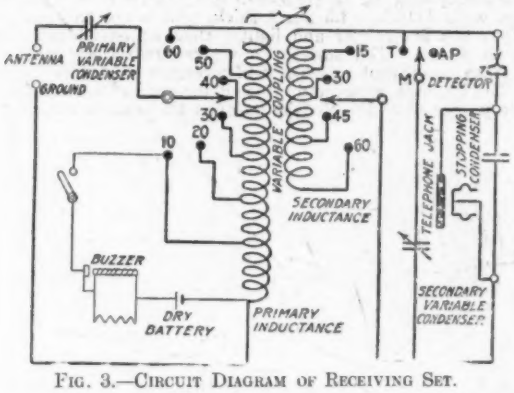


Fig. 3.—Circuit Diagram of Receiving Set.

by a socket joint, slightly conical, the two parts being made of dissimilar metal to prevent rusting together. Simple strain insulators of bakelite material and light guy ropes are also provided.

The earth connection is generally a woven copper mat in direct contact with the earth. In other cases an insulated counterpoise wire stretched along the ground or ground stakes are employed.

Normal service for this combination requires a range of communication of at least 5 miles (8 km.). In field tests the sets here described have operated over 30 miles (48 km.), while with a vacuum-tube detector at the receiving station signals have been received from this transmitting set at 90 miles (145 km.) distance.

A ROTARY-CONVERTER INSTALLATION AT ILFORD.

An interesting installation of converting plant, involving the use of an inverted rotary converter with step-up transformer at the power house and a rotary converter supplying direct current at the sub-station, has recently been carried out by the General Electric Co., Ltd., for the Ilford Urban District Council.

The supply at Ilford is a direct-current one, and before the recent extensions was provided by a 1,000-kw. "Witton" set, shown in the background in fig. 1, and by other "Witton" generators installed in the adjacent engine room.

The district extended to such a degree that it was found impracticable to lay down more copper for feeders, and it was, therefore, necessary to consider some other means of supplying the outlying districts. This question became acute when a large Government factory in the neighbourhood of Chadwell Heath demanded a supply from the Ilford mains, and it was then decided to install a rotary converter at the power house to supply the sub-station at 6,600 volts, three-phase, 50 cycles. At the sub-station

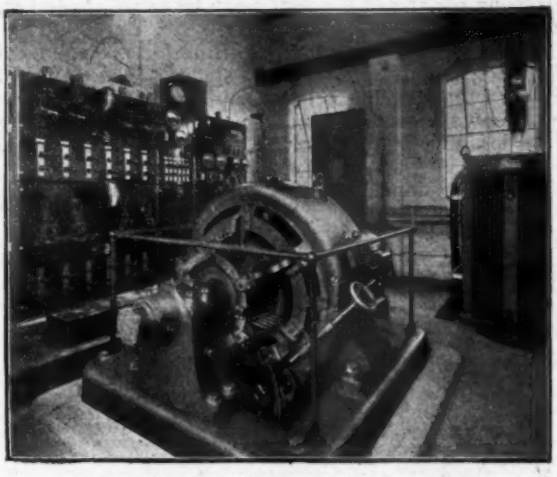


Fig. 2.—"Witton" Rotary Converter and D.C. Switchgear in the Sub-Station.

the high-pressure supply is converted back to direct current for the use of this particular firm, as well as for the district in general.

A contract was placed with the General Electric Co., Ltd., for one 280-kw. rotary converter complete with booster, exciter, and step-up transformer, together with the necessary switchgear at the power house, and for the rotary converter, transformer, and switchgear at the sub-station.

The rotary converter at the power house is of the "Witton" standard type for inverted running, and starts up from the D.C. side; when working off a 480/520-volt D.C. circuit, it gives an output at the terminals of the transformer of 250 kw.

The high-pressure switchgear consists of a G.E.C. standard boiler-plate cubicle equipped with the usual G.E.C. instruments, as will be seen on reference to fig. 1. The D.C. panel is of standard type.

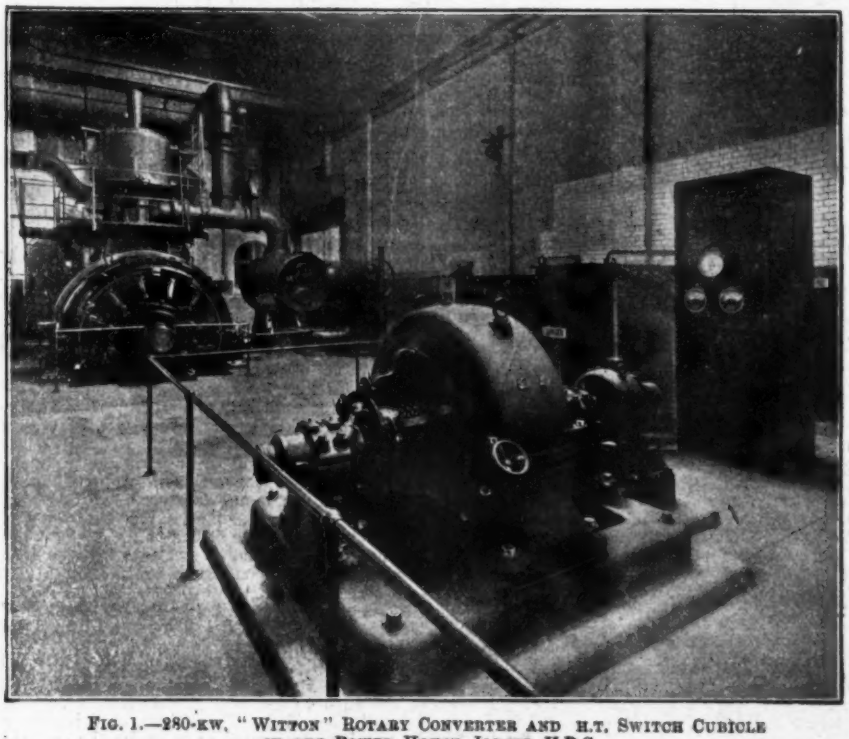


Fig. 1.—280-kw. "Witton" Rotary Converter and H.T. Switch Cubicle in the Power House, Ilford U.D.C.

At the sub-station the three-phase current is brought in by means of a three-core paper-insulated cable direct to a H.T. switch cubicle similar to that at the power house, and thence through a step-down transformer to the rotary converter. This machine is similar to that at the power house, with the exception that it has no exciter, as it is not arranged for inverted running; but it is fitted with a starting motor for starting up from the A.C. side on the self-synchronising method devised by the General Electric Co., Ltd. The converter, which is shown in fig. 2, supplies direct current at 480/520 volts to the network through the switchgear seen in the same view. This switchgear is a typical example of a plug board, and was constructed specially to the instructions of Mr. A. H. Shaw, M.I.E.E., M.I.Mech.E., engineer to the Council, who kindly gave permission for the photographs to be taken and for this description to be published.

In addition to the foregoing, the General Electric Co., Ltd., has received a contract for further extensions at the Ilford Urban District Council power house, including a 2,000-kw. Fraser and Chalmers turbo-alternator, 1,000-kw. "Witton" rotary converter, transformers, five-panel truck-type H.T. switchboard, and the necessary L.T. switchgear.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Meters for Small Currents.

I have only just noticed in your issue of November 29th last a letter written by Mr. R. H. Barbour, in which it is contended that the commutator type of ampere-hour meter is the meter "par excellence" for small currents. While I do not wish to enter into any controversy between Mr. Barbour and Mr. Stubbings regarding the relative merits of the mercury and commutator types of motor ampere-hour meters, I strongly join issue with anyone who contends that the ampere-hour motor meter, whether it be mercury or commutator type, is the meter most suitable for small currents.

The reason is to me obvious, inasmuch as the makers, in their effort to reduce the losses in the meter, do so only at the sacrifice of low starting current. When it is considered that a five-ampere meter having a full-load drop of one volt is frequently called upon to register the amount of current used by a 25-watt lamp, it can hardly be wondered at that the meter after having been in service for some time refuses to start, the drop across its commutator being only 0.02 volt on a 230-volt system.

I refer especially to conditions such as obtain in Australian country towns, where public supply undertakings are installed in townships of 200 and 300 inhabitants, and where meters cannot receive the expert and constant attention which would be accorded them in a larger concern.

I have had very considerable experience with these meters, and have come to the conclusion that the type is not suitable for small consumers, an electrolytic meter being the only type permissible.

Gerald B. Lincolne,

Melbourne, *March 13th*, 1919.

Fault Localising.

On looking over the article on fault localising in the REVIEW of April 18th, I note that in the remarks on the Murray loop test, the contributor points out the complications introduced into the test by the use of connecting leads to the slide wire, and states that if the galvanometer is connected across the cable ends of these leads, then if the leads are of equal resistance they can be ignored, as they do not affect the balance point. A little reflection will show that this is not the case; it is possible, however, to allow for the leads in the construction of the bridge, where the bridge consists of a wire stretched along a scale; then if this same scale is used, the wire is shortened at each end by an amount, which will leave the resistance of the slide wire and connecting leads the same as that of the slide wire alone before making the alteration. In using the bridge, assume the wire to be of the original length, and the balance point is read off on the scale. I find the best method of finding the length of slide wire which has the same resistance as the connecting lead is by passing a current through the lead and slide wire, then taking the drop across the lead; now find the position on the slide wire where the drop from the junction of lead and wire is the same as that of the lead. The lead is now attached to the slide wire at this point, and the other end is treated in a similar manner. The only limitation to the use of this set now is that in the event of a fault being near the testing station it may not be possible to get a balance on the wire; this point can be found by pricking through the insulation of the lead at various points, then measure carefully the length of lead to this point, and calculate the divisions of slide wire that this length is equal to; it is well worth while to divide up the length of the lead into as many divisions as were cut off the slide wire, bare the wire at those points, and tape up.

J. F. F. Dalston.

Perth, *April 22nd*, 1919.

I should like to draw attention to the fact that a portion of the article on "Fault Localising: A Few Hints," by H. Bujama, appears to be rather misleading.

There is no doubt that the resistances of leads and connections introduce considerable errors if they are included in the unknown arms of the bridge, and it becomes necessary to use a formula for correction, especially for low-resistance cables.

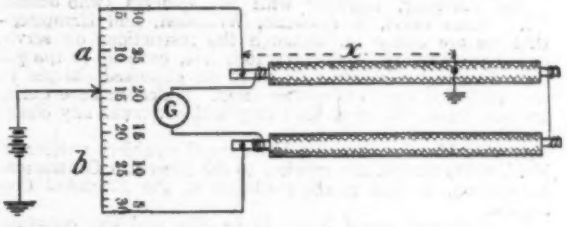
To eliminate this trouble, the writer suggests including the resistance of the leads in the ratio arms, and claims that, provided the leads are of equal resistance, the point of balance is unaffected.

In the first place, it is not good practice to include temporary leads and connections in the ratio arms, especially if the latter are of low resistance.

There is only one possible position of the slider in which the resistance of the leads will have no effect on the point of balance, and that is when it is exactly midway between the two ends of the slide wire, thus giving a one-to-one ratio. If, however, the ratio arms a, b are unequal, say $a/b = 2$, and calling the resistance of the leads d, then, according to the writer $(a + d)/(b + d) = 2$ also.

It is obvious that this equation only holds good when a and b are equal, and, furthermore, the greater the difference between a and b, the greater will be the error.

This difficulty can be overcome by making the leads to some known convenient resistance, and commence marking at one end of the slide wire from this value instead of from zero; then the ratio may be read directly in terms of a and b.



In the figure the resistance of the leads is represented by five scale divisions of the slide wire, and the numbering of the divisions is so arranged that a and b may be read directly. This method has the disadvantage of placing metals having different temperature coefficients in the ratio arms.

A. E. Underdown.

London, S.E., *April 23rd*, 1919.

Trouble with Magnetos.

I should deem it a great favour if you could let me have, *vid* your "Correspondence" Columns, the opinions and experiences of any of your readers in any case where the "make" of magneto on an internal-combustion engine had any relation to the expended H.P. Of course, when I say "make" of the magneto I mean its construction, and I presume that each manufacturer's article must give a different quality of spark.

On the M.T. Co., where I at present am, I have had a deal of trouble with one make of "bus" particularly; the trouble started thus: The lorry was originally fitted with a Bosch magneto; this, however, one day broke down, and, being unable to get spares immediately, I had to put on another make of magneto, it being, however, a dual system, and one very well known (though not Bosch). After a day or two on the road the drivers complained that they could not get up hills without switching over on to the battery. The magneto was taken off and inspected, and was found to be perfect, and was, indeed, put on another lorry, where it has been for six months. Three or four makes of magnetos were tried on the offending "bus," but all to no avail; the complaint was still the same—"She won't pull." One day, however, along comes a Bosch magneto, and I put that on, and lo and behold! "She's as good as ever."

The particular engine has a very high compression, and the plugs are on the sides of the cylinders. The point on the stroke when the spark occurs is the same for every magneto fitted, the engine itself running with fixed ignition, which, if I remember rightly, is 7 deg. before dead centre.

I have had this experience with one or two other makes of lorries, but it was never so pronounced as in the case I mention. I should very much like to know if any of your readers have experienced the same difficulty, and if any can offer an explanation.

Sparx.

B.E.F., France, *April 21st*, 1919.

Searchlight Equipment and Operation.

I have read with interest the article in this week's ELECTRICAL REVIEW by Mr. H. M. Goody on the above subject. There is one point, however, which is either incorrectly stated, or stated in such a way as to be misleading. Mr. Goody states that a number of rays reflected from the mirror are divergent, that they strike the side of the barrel, and are reflected thence through the front screen, making a widely divergent cone of light apart from the main beam, and that concentric rings are fitted to stop all but the parallel rays of light. Now the rays from the mirror are unavoidably divergent, the divergence depending on the diameter of the crater and the focal length, this, however, within the limits of 2½ deg. to 3 deg. is an advantage, as a perfectly parallel beam would be only the diameter of the mirror, and consequently too small to find a target with, or illuminate sufficient of it to be of use should it happen to strike one. It will be seen, therefore, that the concentric rings are not to stop the divergent rays from the mirror, which are necessary to efficient working, but to stop the widely divergent cone mentioned by Mr. Goody. This cone, however, is not from the mirror at all, but is caused by direct rays from the negative carbon, which diverge in the form of a cone, the outside edge of which is a line drawn from the negative carbon tip to the edge of the front window.

J. A. Chapman.

Finchley, *April 25th*, 1919.

"Rules" for Electricity Supply.

Your welcome notes in this week's REVIEW come at a time when supply authorities are going still further with their rules, regulations, and charges, to the detriment of progress; we give a few instances:—

The Hendon Supply Co. for some years have insisted on heating plugs being purchased from them. The company are contractors in the full sense of the word; whilst they test and pass their competitors' work, they have the privilege of passing their own.

The company, together with St. Pancras (who demand "Z" fuses only), Marylebone, Willesden, and Hampstead, that we are aware of, although the restrictions on service mains were raised on January 10th last, have up to the present time made and do now make unauthorised charges for the regulation length of service main. Willesden have during the last week advised us that they will not make any charge in future.

We would refer you to a letter on this subject written by Mr. Tweedy Smith, the solicitor to the Electrical Contractors' Association, in last month's edition of the *Electrical Contractor*.

These charges range from £5 to £20, and the consumer pays or gets no supply.

Watson Marsh & Co. (Hampstead), Ltd.

London, N.W., *April 26th*, 1919.

The Southampton Appointment.

When one's disgust has somewhat subsided after reading the Mayor of Southampton's explanation in connection with the suggested appointment of Mr. H. S. Ellis, of South Shields, one begins to seriously consider how much this mode of procedure is in vogue, and how many similar appointments have been made, and afterwards advertised in the "usual manner," with the usual warning, "Any canvassing of the Committee will be deemed a disqualification"! One can almost discern a smirk of conscious rectitude on the advertiser's lips as he delivers himself of this final adjuration. Seriously, Sir, if electrical engineers are to uphold the high prestige which their profession enjoys, I suggest that the only course for the I.E.E. to follow is to immediately declare a boycott on Southampton, until such time as those responsible for "creating this precedent" are replaced by men of integrity and honour.

No Influence.

April 28th, 1919.

The Lighting of Pusey House Chapel, Oxford, and of the Institution of Civil Engineers' Lecture Room.

I note with interest articles and letters in your April 11th issue on the above. On page 401 of the April 11th issue, the lighting of Pusey House Chapel, Oxford, is described. This article contains a statement of the efficiency of the lighting installation which calls for comment. Tables are given showing the lighting efficiency as expressed in watts per sq. ft. It should be clear to anyone that such values mean nothing, given as they are, without any statement of the illumination intensity. An expression of the efficiency of lighting must state the foot-candle intensity per watt per sq. ft., or in simpler form the lumens per watt. In brief, any data purporting to give the efficiency of a lighting installation must take into consideration something more than energy expended per sq. ft. One might give any figures one liked for the watts expended per sq. ft., as long as the degree of lighting intensity was not stated. This point appears to be totally disregarded in the article in question, and is a serious omission, invalidating as it does the data given, and the conclusions or claims put forth for the work.

I would also comment on the editorial note made to Mr. G. E. Moore's letter on page 405 of the April 11th issue. Mr. Moore's letter calls attention to the scientific lighting of the House of Commons by skylight effect from luminous panels in the ceiling of the room. Your editorial comments remark as to the possibility of being "too scientific," and you instance the disappointing results obtained in the lighting of the lecture room of the Institution of Civil Engineers. This is an unfortunate installation to put forward as a sample of illuminating engineering, as it is certainly not a good example. The trouble in this case is that too much has been attempted with too little. The lecture room in this institution is a very long and wide room, and an attempt has been made to light it with lamps placed behind the cornice around the room. The result fails because it is not possible to illuminate a room having the length and breadth of this lecture room by cornice lighting. Cornice lighting can only be successful where the width and length of a room does not exceed a given maximum.

The defects of the lighting of the Civil Engineers' lecture room could be corrected, and the indirect lighting made a perfect thing of its kind by the installation of a few indirect fittings, of suitable size and type, suspended from the ceiling, thereby supplementing the insufficient cornice lighting, in the main or central portion of the room.

It is unfortunate that the Institution of Civil Engineers has repeated the same unsuccessful form of installation as had been tried at the Institution of Electrical Engineers' lecture room. Such bad examples, which fail by their insufficiency, when allowed to continue uncorrected, tend to cause prejudice in many people's minds against indirect lighting—a form of lighting which, when properly designed, gives a most agreeable, effective, and satisfactory illuminating result.

F. W. Willcox.

London, E.C., *April 28th*, 1919.

[We refer to this matter in a leaderette.—EDS. ELEC. REV.]

The E.P.E.A. Award.

Mr. Connaught T. Smith's remarks on the above award in your issue of the 25th inst. caused me considerable surprise, and I sincerely hope that there are not many undertakings whose technical staffs have so far received "specious promises" only.

I recommend your correspondent to get into touch with Mr. Faraday Proctor, The Exchange, Bristol, who generally knows all that is worth knowing on this and other matters concerning the welfare of our industry, when no doubt he will find that the undertaking he is concerned with is in a very small and unenviable minority.

So far as this undertaking is concerned the committee carried out the terms of the award to the letter immediately the award was given.

R. Sidwell.

Bath Corporation Electricity Works, *April 28th*, 1919.

I am certain many engineers are being forcibly brought to the same conclusion as Mr. Connaught T. Smith when considering the attitude of the above association. It is with regret that one has to bring censure upon the union which has such excellent principles and intentions, but up to the present very little has been done to make these intentions bear fruit, and to place the members on a financial basis in accordance with their professional responsibilities.

Promises have been made from the time of its inauguration, but what are wanted are not promises, but definite action and results.

The basic-rate question has been on the agenda for months and still months pass without the faintest hope of a settlement, and when this time arrives, where are the mandatory powers to compel the councils and employers to pay the agreed rates? The same trouble will arise over this, as occurred over the belated 20 per cent. + £90 bonus, which apparently has not been settled in Mr. Smith's case.

When one considers these facts, one comes to the conclusion that there is obviously something wrong with the methods of an association which can only bring about a bonus, so many months after a bonus was justified. I do not know where many central station engineers would have been (financially), but for the action of the non-technical unions in the matter of bonuses, for in many cases staff engineers fortunately, participated in these.

There undoubtedly seems to be a want of system, ability to negotiate, or strength of mind when important matters, like the above, are being dealt with.

I think central-station engineers know what councils do with their employés (both technical and non-technical)—nothing, until pressure is applied.

It is absolutely no good attending a conference of councillors and chief engineers with kid gloves on, to discuss basic rates or bonuses; one has to go prepared to fight and to fight with a firm hand.

The feeling at the high court of justice (injustice?) is that the E.P.E.A. members are a very decent set of fellows, and would never think of doing anything drastic.

They will remain so if they are treated fairly, but I think my brother engineers will agree that patience can be tried too long.

Nil Desperandum.

London, N., *April 26th*, 1919.

A Demand Better than 100 per cent. Load Factor.

The hope of very general adoption of electrical heating and cooking apparatus will be difficult to realise unless we strive to popularise the application of thermal storage.

It is difficult to understand why the importance of cultivating the water heating load is not better appreciated by managers of supply undertakings with, perhaps, the solitary exception in this country of Mr. Bell, of Hammersmith, who essayed useful pioneer work with his thermal apparatus, which was handicapped by being manufactured on too complicated and expensive lines, and by claiming for it more than it was practicable to achieve.

If we consider the case of a small household of four persons, who are already in the habit of availing themselves of the public baths, then a daily supply of ten gallons of water at 150 deg. Fahr. will be amply sufficient for that household. If the tank, sink, and lavatory basin are so located as to minimise heat losses from pipes, then it is possible to get this hot water supply with a 180-watt heating element in the ten-gallon lagged tank, on the assumption that it is left in circuit for 22 hours per diem, and cut out by means of a time switch at the peak period. Cost: 1s. 2d. per week at 0.5d. per unit.

This would surely be a highly desirable load to cultivate, and when the industrial classes have learnt to appreciate the convenience and economy of a supply of electrically heated water, then the system will extend, and a very important change in the character of the load curve will result.

Water for tea and cooking would be drawn from the hot supply and boiled up on the electric stove, which latter and the oven may also involve the principle of thermal storage, but of this, more anon. In the meantime, I would like to learn the views of supply authorities as to the advisability of encouraging a demand that would be better than 100 per cent. load factor. I mean an off-peak demand.

C. Orme Bastian.

London, W., *April 28th*, 1919.

COAL CONSERVATION.

In his third Cantor lecture on this subject at the Royal Society of Arts on March 24th, Prof. W. A. Bone, F.R.S., dealt with the question of power supply in relation to schemes of reconstruction. He said that in the opinion of many competent judges, the question of increasing and reorganising the supply of power for industrial purposes was one of the most important problems which the country would have to undertake during the coming decade of reconstruction. It might be expected that those who were alive in 1930 would see in operation a comprehensive scheme of public power supply and distribution on co-operative lines, so organised and administered that every power user in the country would have the right to participate, according to the magnitude of his requirements, on the same terms and conditions as all others. Important industrial and social consequences would follow. There was installed throughout the United Kingdom between 10 and 15 million H.P. According to the 1907 Census of Production, of the total capacity of prime movers, 26 per cent. was associated with electrical plant, and about two-thirds of this was engaged in public utility services. In that year public utility services were practically all electric, whereby power was generated co-operatively, and the average load factor was only about 16 per cent. The individualistic basis upon which practically the whole of the mechanical power was generated in this country during the 19th century, was the outcome of the natural limitations under which the steam engine and the boiler laboured unless associated with the dynamo, which was invented much later than the steam engine. It was the invention and development of the dynamo and electric motor that made it possible, at the beginning of the twentieth century, to organise big public power schemes on the principle that the power required in a given industrial area should be generated where it could be most economically produced.

If it were agreed that power was most efficiently applied to industry through the medium of electricity, then undoubtedly there were great advantages to be gained in the way of cheap production by the co-operation of consumers with properly organised electric power schemes operating over large industrial areas. No other country in Europe was so well adapted as our own for such co-operative schemes, because of the compactness of our industrial areas, the densities of their population, and their proximity to the coalfields. If all the manufacturers in such areas were linked up with a few large and efficient power stations, instead of having their own independent and inefficient power plant, and supposing the electricity supply authority purchased the surplus gas, waste heat, and exhaust steam from its customers, and converted it into electricity, it was fairly obvious that greater economies would be achieved than would be possible under any purely individualistic scheme.

Everyone was agreed that our colossal war debt could only be paid off by vastly increasing the productivity of labour, and it was only by increasing the amount of power used per worker that the net output of the individual worker could be increased. By net output he meant the value added by the worker to the material he operated upon, *i.e.*, the selling value at the factory minus the cost of the material used. Clearly the worker could not be paid more in wages than a certain proportion of the value he added to the materials, and if he already received a fair proportion, he had no justifiable ground for demanding more unless or until he increased his net output. Hence it followed that if net output, and consequently wages, were both to be increased, more power per worker must be employed in industry.

There could be no doubt that before the war power was generated very inefficiently in this country. There were grounds for believing that the consumption of fuel was not less than 5 lb. per B.H.P., and that meant that on the average we were only utilising about 4 per cent. of the available energy in the coal burned, the other 96 per cent. being wasted. That alone ought to make us profoundly dissatisfied with the present system. He had always believed that in the long run the principle of co-operative power production in a densely populated industrial country like ours would become the accepted custom, and if that principle was accepted, there seemed to be no other really effective way of putting it into operation except through the medium of electricity. If he wanted heat, except for very special purposes, he would certainly use gas, but for power for industrial purposes he would certainly use electricity. For heating purposes electricity must be ruled out. He said this to show that he was not an advocate of electricity as a panacea for everything.

The production of power was becoming more and more a specialised process. When coal was being burned on a large scale, for special purposes, there was a science of combustion and of heat transmission, a very complicated science, and they must train up men who would make it their business to study the thing specially. Further, the most economical generation of power was only possible with larger units and a better and more economical load factor than most individual establishments could employ. In large power stations, equipped with the largest and most modern units, superintended by specially trained fuel and power engineers, it was possible to burn under the boilers with good average results, inferior grades of coal, whilst the recovery of by-products would be more feasible in connection with such stations than with small private plant. If by this means an efficiency of only 10 per cent. was got out of the fuel, that was better than leaving it at the pit never to be used at all. That was a point which the critics of the recommendations of the Coal Conservation Sub-Committee overlooked. They seemed to assume that the best steam coal was going to be used in these power stations. On the contrary, a fuel would be used which but for such a scheme would never be used at all, and in that way it would facilitate the export of the best coal, which was necessary having regard to our great foreign debt. The next point was that co-operative electrical power production would facilitate the development of rural industries, and greatly assist small manufacturers. Further, cheap electrical power throughout the country would mean that an electric motor would become part of the equipment of every house, a great boon to overworked housewives, and one which was bound to have important social consequences. He was not looking at this matter from the narrow point of view of the exponent of gas or the exponent of electricity, but from the broad point of view of public policy.

Having outlined the proposals of the Coal Conservation Sub-Committee, Prof. Bone discussed the choice of prime movers. During recent years such great advances had been made in the development of the steam turbine that it had for the time being out-distanced the gas engine as a power-station machine, except for small units of, say, 300 B.H.P. capacity. From the point of view of thermal efficiency, there was little to choose, the figure in both cases being about 20 per cent., when both were working under the best conditions, but from the point of view of the size of units, the turbine had shot far ahead of its rival. On the other hand, for comparatively small units, where the load factor was uniformly high and not subject to abrupt variations, the gas engine had certain advantages. The choice between the two types, however, would not turn on purely thermal considerations, but on other equally important factors.

The public seemed to have run away with the idea that it was proposed to put up generating stations near the collieries. That was not stated in the report, and it was not necessarily so. It all depended on the circumstances. It might be advisable to put the power station at the colliery, or in another place where there were better facilities for condensing water. If a low-grade class of coal was to be used which would not stand transportation, that would be a reason for going to the colliery, but the position of the power stations was a matter which must be decided according to local circumstances. An adequate supply of condensation water was most important, and a good many power stations had been crippled because that had not been taken into account.

He thought there had been some misunderstanding on this matter. Prof. Cobb, in an article in the *Edinburgh Review*, and Sir Dugald Clerk, in his paper at the Royal Society of Arts, the previous week, said that the best electric power station was working with an efficiency of only 13 per cent. Something better than that could be shown. One of the large power stations in this country working on an inferior grade of coal of 10,500 B.TH.U. per pound, had a coal consumption corresponding to 19,500 B.TH.U. per KW.-hour sent out from the station. That gave an efficiency of 17½ per cent. He was also informed that in a large super-station now in course of erection in the country, and which would probably be in operation by the end of the present year, no more than 16,000 B.TH.U. would be expended per KW.-hour sent out, which would give an efficiency of 20 per cent.

Some of the criticisms of the recommendations of the Coal Conservation Sub-Committee seemed to suggest that the members of the committee were mesmerised by some influence and fell down before electricity. In the criticisms which he had seen, the most important considerations had not been referred to. The considerations which determined the opinions of the sub-committee, and certainly his own, were purely scientific and economic. Those and those alone enabled him to make up his mind to become a signatory to the principles in the report. He hoped the country would take up this matter, and have it carried out on comprehensive lines.

THE LABORATORY AND THE WORKSHOP.

At the annual general meeting of the Institute of Metals, on March 26th, Dr. W. R. Barclay discussed the relationship between the laboratory and the workshop. He pointed out that since the laboratory was a "place where scientific experiments were carried out," and every branch of human industry fundamentally was "applied" science, the ultimate basis of both laboratory and workshop was the same. The keyword as to their relationship was therefore, "co-operation." Essentially they had the same principles of operation and the same objects of accomplishment. The scientist in the laboratory, the workman in the workshop, equally relied on the immutability of the laws of nature, chemical or physical. To the workman this was not always clear, but in point of fact he also, like the scientist, was something of a mathematician, a chemist, a physicist, and a geologist, though rarely realising the fact. And the objects of both laboratory and workshop were, or should be, the production of that which should be of service to the community. They were both links in the chain binding organised communities of men and women together, and making possible our modern civilisation. Only when all the implications of this were fully understood could both be efficient.

In industrial practice this should be the ideal. The works laboratory would then be continuously reinforcing the works foundries, shops, mills, and plant. The laboratory should examine not only all incoming and outgoing materials used or produced, but also the efficiency of works processes and methods, and should study the human factor in industry, seeking always to render workshop life less irksome. It should further act as the works intelligence department—ever on the alert for new discoveries, tapping all sources of experience and knowledge, and endeavouring to apply these to the particular industry in which it was concerned.

The laboratory staff should always include an engineer or a scientist with considerable engineering knowledge. Too often it was considered to be the domain of the chemist alone; yet every branch of applied science should be its concern. Above all, however, it should seek to establish the completest sympathy with the skilled workman. Often he was a severe critic of the laboratory, but let the spirit of helpful criticism on both sides be encouraged, and the scientist would often learn as much as he could teach.

Labour was going to take a much more prominent part in the management of industry than before the war. This would be a movement in the right direction, if this spirit of co-operation in respect of the scientific progress of industry was developed, and the scientific staff of the works could accomplish much by the exercise of tact and judgment. The secret of success in handling men was to get them to take an intelligent interest in their job.

The author believed that sooner or later we should develop on these lines—in spite of the dark outlook that sometimes appeared, as we read and heard of strikes and syndicalist movements, and general industrial unrest. After all the world would go on, and the continuance of life depended upon the continuance of production; wars or no wars, revolutions and counter-revolutions notwithstanding, we must hammer out some system for the carrying-on of industry.

The young technical man of to-day had a great life before him. It would mean work, hard work, but it would mean living and not rusting. And experience showed that the joy of life lay in the full use of it.

Dealing with "The Scope of the Works Laboratory," Mr. F. C. A. H. Lantsberry, M.Sc., said that the future industrial prosperity and commercial supremacy of our whole Empire depended to a very large extent upon the application of science to industry. Now there was a desire on the part of manufacturers to possess laboratories with an efficient staff, and there was the will to succeed on the part of the staff. So long as the two could adopt the right attitude towards each other, success was assured. Right from the outset the laboratory staff should recognise that the works was not a philanthropic institution. The success of a laboratory depended upon its being able to turn its activities and accumulated knowledge into money, and was not in any way proportional to the product of the number of chemical estimations and the number of mechanical tests it could do in a specified time. The manufacturer, on his part, must be imbued with the right scientific spirit, and must be prepared to take the laboratory into his fullest confidence. It must be recognised that the task set was a most complex and difficult one, and one which was not rendered simpler by the fact that its activities were bound to meet with a certain amount of opposition born of prejudice. The scientific worker must be given a status which was at least equal to that of the barrister, lawyer, or doctor. And, after all, why should it not be so, for was not his training as rigorous? The manufacturer must recognise that to the scientific worker a knowledge of chemistry, physics, the principles of engineering, mathematics, metallurgy, drawing, geology, and modern languages were absolutely essential. Was the man who had the intellect and patience to acquire a knowledge of these subjects to be treated lightly? The success of a laboratory depended on: (1) Possession of a proper equipment, which included an ample number of properly trained scientific workers; (2) mutual existence of the right attitude of mind between the works and the laboratory, and (3) complete confidence and sympathetic assistance of the management.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Hart Starter and Lighting Battery.

The Hart Accumulator Co., Ltd., Stratford, London, have introduced a starter and lighting battery, type "M.S.L.," which is interchangeable with the starter batteries fitted in most American motor-cars, and is specially designed to discharge at very high rates without injury, while the internal

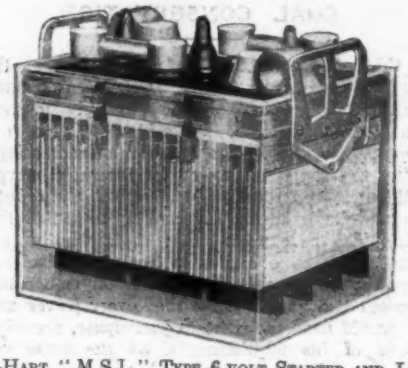


Fig. 1.—Hart "M.S.L." Type 6-volt Starter and Lighting Battery.

resistance is very low. A "ghost" view of one of these batteries is given in fig. 1, from which it will be seen that the outer wooden case is fitted with convenient handles; the cells are contained in strong ebonite boxes. These batteries are made in two sizes, giving 6 and 12 volts respectively.

"Xcel" Heating Apparatus.

A large company which has been engaged on munition work during the war has turned its attention to the manufacture of electric heating and cooking apparatus, which will be of entirely British manufacture. It is its intention first to specialise in the popular table lines, previously imported from abroad, and the iron here illustrated is the first article put on the market. This iron is said to be of the highest finish, and to have many excellent points, amongst them being a replaceable element, special connector with insulated

Fig. 2.—"Xcel" Electric Irons, and Parts.

rod, taking up the slack in flexible, permanent stand at back, &c.

The products of the company will be known under the trade name of "Xcel," and the whole of the output will be marketed by the following firms, to whom all inquiries should be addressed:—

Berry's Electric, Ltd., 86, Newman Street, W.
Downs & Davies, 1-3, Stanley Street, Liverpool.
Drake & Gorham, Ltd., 67, Long Acre, W.C.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames Street, E.C.
Sun Electrical Co., Ltd., 118, Charing Cross Road, W.C.

Priority Closes Down.—The Priority Department of the Ministry of Munitions is being closed, and Lieut.-Col. A. H. Burgoyne, M.P., has relinquished the position of Controller of the department.

BUSINESS NOTES.

Export Licences.—It is officially announced that His Majesty's Customs have now been instructed that all export licences are to be considered as of unrestricted validity, even though a time limit for shipment may be stipulated therein.

Fire.—About £1,000 damage was caused by fire at the electric light power house at Tarvit, near Cupar, Fife. The plant was totally destroyed.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for April 25th and 29th.

British Transport Charges.—The Traders' Traffic Conference of Birmingham has addressed a letter to the Prime Minister, the President of the Board of Trade, the Home Secretary, Mr. Bonar Law, and Sir Eric Geddes, urging the seriousness of a statement made by Mr. Bonar Law, on March 23rd, from which it appeared that the Government contemplated a general increase in the rates charged by the railway companies for the conveyance of merchandise over their lines. Members of the Conference view with grave apprehension the possibility of any increase in the already high charges for transport which exist in this country. It is generally admitted that these charges are substantially higher than those operating in competing countries, and one of the urgent needs of to-day, if the commerce of this country is to be successful and unemployment is to be avoided, is not higher, but lower rates, and more efficient service. The letter says:—"If British manufacturers are to be enabled to exist, if unemployment is to be avoided, and the flow of exports, on which the solvency of this country must largely depend, is to be maintained, it is confidently submitted that much more sympathetic consideration in the matter of transport will be required. . . . It is felt that any increase in transport charges at the present time could only prove disastrous, not only to manufacturers by limiting output, and to the industrial population by creating unemployment, but also to the railways themselves by preventing, at least, any increase in traffic, from which source the railways might primarily look for increased revenue." The letter further asks for an assurance that if any increase of rates is contemplated, the traders shall have an opportunity of being heard as to the effect of such increases, before any decision is arrived at.

Business Representation in Russia.—A considerable number of merchants and business representatives who formerly lived in Russia are at the present time in the United Kingdom, owing to the actions of the Bolsheviks. As a considerable part of the former Russian Empire is now available for trade, it may be that firms in this country would be glad to take advantage of the present exceptional opportunity of obtaining the services of these men, who are especially well qualified to open up trade with Russia. The Department of Overseas Trade would be glad to hear from any firm that desires to be brought into touch with the persons referred to, either immediately or later on, when trading in a more general way can be conducted with Russia. Inquiries should be addressed to the Russian and Scandinavian Section, Sunderland House, Curzon Street, Mayfair, W. 1.—*Board of Trade Journal.*

Trade Openings in Italy.—The British Chamber of Commerce for Italy (Inc.) has issued from its headquarters at Genoa a new list of openings for British articles in Italian markets:—

No. 1,662.—Tortona merchant, handling iron, steel, metals and engineering articles, seeks connections with British manufacturers and shippers.

No. 1,668.—Ex-officer (Engineer), at Cornigliano (Genoa), seeks connections with British firms interested in the exportation of industrial machinery in general.

No. 1,673.—Genoa engineer requires agency for metals, electrical machinery, machine tools, &c.

No. 1,676.—Spezia depositary agents wish to represent manufacturers of iron, steel, metals, machine tools.

No. 1,679.—Genoa commission agent has openings for chemicals, steel, engineering articles, lubricants, paraffin, &c.

No. 1,680.—Engineer at Florence seeks agencies for electrical material and machinery.

No. 1,685.—Agent at Bari has openings for machine tools, metals, &c.

No. 1,690.—Commission at Genoa agent is interested in engineering articles in general, boiler valves and cocks, pumps, agricultural machinery.

No. 1,694.—Turin engineer seeks agency for electrical sundries.

No. 1,698.—Mechanical engineer at Cagliari (Sardinia) would accept agency for cast-iron and steel water-pipes, boiler tubes, galvanised water and gas pipes.

No. 1,704.—Old established firm at Genoa would handle, for their own a/c and on commission, electric and hydraulic material, engineering articles.

No. 1,717.—Party at Novi Ligure inquires for addresses of manufacturers of telephonic apparatus.

No. 1,720.—Party at Turin would handle, both on commission and for own a/c., electric materials, &c.

No. 1,730.—Merchant at Naples would import on commission, and for own a/c, electric articles.

Welfare Work.—The Phœnix Dynamo Manufacturing Co., Ltd., have taken a lease of Grange Farm Estate, which is close to their works on Bradford Moor, with a view to having it laid out as playing fields and recreation grounds, and the farm buildings are to be adapted for use as a social club. The estate is henceforth to be known as "Phœnix Park." An annual income of about £800 per year is assured, and the scheme is under the management of Miss Matthias, the works welfare superintendent.

Coventry Technical College Scheme.—It was stated at Coventry City Council that the new technical college would probably cost £150,000, and that local manufacturers were likely to contribute £50,000.—*The Times.*

Works Dinner.—The workmen of Messrs. Ferguson, Pailin, Ltd., recently arranged a dinner at the Wheatsheaf Hotel, Manchester, to which they invited the staff management. The gathering was highly successful in bringing employers and employés closer together, and making for a better understanding between them. The chair was occupied by Mr. W. J. Freeman (works), who in the course of an interesting speech appealed to both workmen and management for tolerance. Mr. S. Ferguson (managing director) replied, and pointed out that in the great majority of cases the interests of both employés and employers were identical, and signified the willingness of the management to have the full co-operation of the workmen in the discussion of all questions in which they were directly interested. The musical part of the programme terminated with the singing of "Auld Lang Syne."

Catalogues Wanted.—The Warrington Electrical Co., Ltd., of 82, Sankey Street, Warrington, ask us to repeat their invitation to manufacturers to send catalogues, as only three have been received.

Export Restrictions.—The *London Gazette* for April 25th contains particulars of relaxations in export restrictions.

British Trade-Mark Applications.—Below we give a summary of the recent applications for British trade-marks in respect of materials and productions connected with the electrical industries:—

Britmac. No. 385,678. Class 13. Electrical fittings and accessories. C. H. Parsons, Ltd., 151½, High Street, Bordesley, Birmingham. October 17th, 1918.

Glovrit. No. 387,907. Class 8. Electric cables. W. T. Glover and Co., Ltd., Trafford Park, Manchester. January 28th, 1919.

Orbit. No. 387,346. Class 8. Electric batteries (medical). The Orbit Electrical Co., Ltd., 2, Coleman Street, London, E.C. January 6th, 1919.

Namco. No. 387,115. Class 13. Sparking plugs. Isaac E. Walton, trading as the Northern Automatic Machine Co., Byre Lane, High West Street, Gateshead. December 23rd, 1918.

Sunco (lettering and design). No. 387,061. Class 8. Electrical fittings and accessories, but not including cables for electrical purposes, dry cells, or similar goods. The Sun Electrical Co., Ltd., Neal Street, Long Acre, London, W.C. December 20th, 1918.

CCCC (four C's in leaf design). No. 388,225. Class 8. Rubber-insulated electric cables. Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. February 11th, 1919.

Velikoid. No. 386,518. Class 50. Electrical insulating materials; insulators, and insulating electrical fittings. Mr. Charles W. C. Bate, Daw Bank Works, Wellington Road South, Stockport. December 4th, 1918.

New French Electrical Companies.—There has been formed at Lyons, the Ateliers de Constructions Electriques des Lyon et du Dauphiné, with a capital of 6,000,000 fr. The company embodies the old-established firm of A. Grammont.

The Société Anonyme des Etablissements Galey Frères, is the style of a new company formed at Paris, with 2,000,000 fr. capital, with the object of carrying out electric installations.

Etablissements Dubray et Lucas is another new Parisian concern, with a capital of 600,000 fr., whose scope is the general application of electricity.

Imports into Holland.—It is stated that restrictions on the import into Holland of overseas goods are rescinded, so that the Netherlands Oversea Trust has received authority to grant licences for unlimited supplies of all goods except war material. Dutch firms which have hitherto been on the black list will enjoy the same facilities for the import of oversea goods as all other firms.

Belgian Industries.—Mr. Herbert Samuel has been appointed by the British Government as a Special Commissioner in connection with the reconstruction of Belgian industries. He has a staff which includes several technical experts, and he proceeded to Belgium last week. The address of the British Commission over there will be 30, Boulevard de Waterloo, Brussels, but in London correspondence should be addressed to the Belgian Section of the Department of Overseas Trade, India House, Kingsway, W.C. 2.

Lodge Fume and Dust Recovery Plant.—The Lodge Fume Deposit Co., Ltd., of Birmingham, is going through the form of liquidation, (Mr. C. B. Flint, of Temple Row, Birmingham, is liquidator) in order that the present business may be acquired by a new company which is in course of formation, to be called "The Lodge Fume Co., Ltd." The object of the formation of this new company is to meet the increasing demand for the fume and dust-recovery plants manufactured by the company, and to develop the business on a larger scale. The new company, which will be a private one with a capital of £100,000 in £1 shares, will take over all the assets and liabilities of the old company, and the management will be identically the same as at present.

G.E.C. Sports Club Resumes.—A fairly large percentage of the staff of the General Electric Co., Ltd., having been demobilised, it has been decided that the Sports Club shall now be revived. A ground has been secured at White Hart Lane, Tottenham. The club will be pleased to hear from any of their old friends who are desirous of fixing up games for cricket or football. Communications regarding cricket should be addressed to Mr. H. O. Joseph, and for football to Mr. H. P. Wells, at 67, Queen Victoria Street, London, E.C. 4.

The Swiss Electrical Machinery Industry.—A review of Swiss trade in 1917, by the United States Consul at Basel, gives some interesting items of news regarding electrical activities during that period. The demand for electrical machinery and equipment was heavy throughout the year. As the use of gas was cut to less than half of the normal needs, and wood and coal were scarce and dear, efforts were made in private homes and in industrial plants to replace heat and power with electricity. Raw materials, especially electrolytic copper, could not be had in sufficient quantities to meet the demand, and prices rose to many times the normal. Large electrical machines could not be sold or delivered without Government permits. Electrical insulations, especially high-tension insulations, were in demand. These were manufactured and sold profitably in the district and also exported to France and Italy. A new industry for manufacturing electric heaters was established, and was able throughout the year to dispose of its product. This heating apparatus is constructed of composite stone, with inside wiring, and heats during the night at a low current rate. The industrialising of the small villages has created a heavy demand for small motors. In almost every village in this district there is some kind of factory which gives employment to the inhabitants between the crop seasons. Some of the machine factories in the Basel district built to fill war orders were compelled to close, as nearly all orders for ammunition were completed, and but few contracts were renewed. The high prices demanded by Germany for iron, beginning August 1st, 1917, curtailed the profits on machinery contracted for before that time. The advance over former prices for iron deliveries after August 1st was £3 10s. per short ton, and prices continued to rise until September, when an agreement was entered into stabilising them. From the beginning of the war to September, 1917, iron of all kinds advanced from 700 to 800 per cent. Heavy construction and the electrifying of railways were hindered by these advanced prices.

Technical Men for Canada's Future Development.—An appeal for co-operation in assisting returned technical men was made by Mr. Fraser Keith, secretary of the Engineering Institute of Canada, at the Montreal electrical luncheon on March 19th. During the next ten years, said Mr. Keith, Canada would witness the greatest industrial expansion in the history of the world. This would involve the development of her natural resources, and the connecting link between these resources and their conversion into national wealth was the technical man. Every advancement had been made by the solution of some technical problem. Besides her wonderful natural resources, one of the greatest assets that Canada possessed was the technical man, a fact which was not generally recognised. Technical men would be needed as never before. There was, however, a very serious danger confronting the country. The war had drained the universities and technical schools of some of the very best men, and the danger was in connection with the return of these men. If they were not assisted in the matter of finding suitable positions the technical knowledge gained before the war would be lost. The co-operation of the Federal Government and the various technical associations had been asked with a view to solving the problem. It was absolutely necessary that some scheme should be devised whereby the technical men should be established in civil life. Between 3,000 and 4,000 technical men had gone overseas, and the country owed these men everything that was possible in the way of assisting them to secure suitable positions. He asked the co-operation of those present to this end. It was agreed that the Committee of the luncheon should assist in the way suggested by Mr. Keith.—*Canadian Electrical News.*

Canadian Mission in London.—The Canadian Mission, which has recently been established in London at 1, Regent Street, S.W. 1, by the Dominion Government, was constituted by an order of the Canadian Privy Council in November, 1918, and Mr. Lloyd Harris was appointed chairman of the Mission. Mr. Harris is a Canadian business man who has a wide knowledge of the new industrial Canada, which is one of the products of the Great War. He rendered invaluable service to the Dominion and to the Allied cause as head of the Canadian War Mission in Washington, and it was at the personal request of Sir Robert Borden, the Canadian Premier, that he consented to undertake his present duties. The objects of the Mission are briefly :—

(*a*) The serious tonnage position arising out of the war, coupled with the numerous restrictions put in force, both in the United Kingdom and in Canada, on import and export trade, tended to sever numerous old connections which had existed for generations between the Mother Country and the Dominion. It is one of the duties of the Mission to study the question at first-hand, and to devise the means of re-establishing the traditional value.

(*b*) A great work of reconstruction and reorganisation must be undertaken in Europe during the next few years in order to repair the devastating effects of the war. Raw materials, &c., will be necessary for this work, and many articles required can be obtained from Canada. The Mission hopes by means of negotiations with the Governments of the countries concerned to make arrangements for the supply of such goods to the advantage of all interests involved. It is, further, considering how by a system of credits to assist the Governments in purchasing the materials.

(*c*) The Mission is convinced that the re-settlement of Europe is largely dependent on sufficient supplies of food being available and distribution being properly organised.

In addition to foodstuffs of every description, Canada has available for export: automobiles and other vehicles, gasoline launches, aluminium, calcium carbide, asbestos, iron and steel manufactures, copper, nickel, coal, and agricultural implements. Canada seeks, above all things, to develop a larger interchange of trade with the Mother Country, and, indeed, with all parts of the Empire. Canada has large markets to offer British manufacturers, for she is a large buyer. Canada, too, feels that she can supply to this country many of the materials and manufactures which formerly were bought by Britain from the Central Powers. The Mission personnel includes, besides Mr. Lloyd Harris, several other prominent Canadian business men who are well acquainted with the present industrial and economic position in Canada. They will at all times be willing to advise persons in the United Kingdom desirous of obtaining information with regard to Canadian trade.

Output of Iron and Steel.—The following statement as to production of iron and steel in the United Kingdom is issued by the Ministry of Munitions, being the weekly average in tons during March :—

Pig-Iron.	Tons.
Hematite : Output	61,000
Furnaces in blast	103
Basic : Output	51,000
Furnaces in blast	81
Foundry, forge, and other qualities :—	
Output	39,000
Furnaces in blast	99
Alloys : Output	5,000
Furnaces in blast	12
Total pig-iron : Output	156,000
Furnaces in blast	295

Steel ingots and castings: March weekly average, 174,000 tons.

The Black Lists Withdrawn.—The Allied and Associated Governments decided that as from midnight, April 28th-29th, all black lists published by them of firms and persons should be withdrawn, and that all disabilities attaching to trade and communication with firms or persons on such lists should cease to operate. The Governments reserved to reserve the right to re-introduce all or any of such lists should such action become necessary.

It is stated that, in view of the suspension of restrictions on exports from the United Kingdom to firms appearing on the statutory list and to certain other firms in neutral countries against which warnings have been issued in the past, it will not be necessary until further notice for firms in this country to consult the War Trade Intelligence Department concerning firms abroad with which they wish to trade.

It is further reported in the Press that the announcement on the subject of trade with the left bank of the Rhine, issued by the Board of Trade on March 14th, is now cancelled. It will no longer be necessary for exporters to obtain licences from the Export Licence Department before shipping to the territories on the left bank of the Rhine, in the occupation of the Associated Governments, goods other than those included in Lists A and B of prohibited exports.

Unemployment: An Appeal to Employers.—We commend to the serious consideration of all firms who are in want of workers of any kind, the important appeal that has been issued by Sir Robert S. Horne, Minister of Labour. They are asked to notify their requirements of labour, skilled and unskilled, to the employment exchanges, and also, as far as possible, to advise the exchanges well in advance of intentions to discharge labour where any considerable numbers are involved. The exchanges, as the medium of payment of out-of-work donation, have knowledge of the classes and numbers of workpeople awaiting employment in the district in which they serve, and are able also to introduce labour from other districts when the necessity arises. It is of the utmost importance that the Government should be kept informed of the extent to which employment is increasing or decreasing in each area, in order that, with the assistance of the local Advisory Committees connected with each exchange, preparations may be made for the absorption of surplus labour.

Exports to China.—With reference to the lists of firms mentioned here periodically for some time past, it is now announced that exports to China and Siam may be consigned to any person or firm in China and Siam respectively.

Sweden and the Black Lists.—A Reuter dispatch from Sweden records the general satisfaction with which business men in Stockholm received the announcement of the abolition of all the Allied Black Lists.

Sterling Footballers.—The Sterling Telephone Electric Co., Ltd., Lady Footballers finished the season by a victory over Messrs. Hoffmann's Ladies at Chelmsford. For the second season they have not suffered a reverse, and have the following remarkable record :—

Played.	Won.	Drawn.	Lost.	Goals. For.	Goals. Against.
36	34	2	0	201	14

This season they have only had four goals scored against them, and three of these were scored by the R.A.F., Hornchurch.

The Sterling Gents have also had a good season, and finished third in the East and South-East London Munition League. On Saturday last, in drawing with Hoffman's Gents (holders of the Chelmsford and District Charity Shield), they accomplished a very good performance.

Plant for Disposal.—The Ministry of Munitions is inviting offers, by May 15th, for a number of A.C. motors, 200 volts, 50-cycle, two-phase, with starters and accessories, lying at the Daimler Works, Coventry. Full particulars are given in our advertisement pages to-day.

Government Controls.—It is announced that most of the Government controls affecting the sale and distribution of commodities will come to an end on May 31st.

Trade Announcements.—Mr. S. J. Bradley, electrical engineer, has reopened his business at Caen Street, Braunton, Devon.

Mr. T. A. Griffin, ex-lieutenant R.G.A., formerly construction engineer in Scandinavia for the Sperry Gyroscope Co., of New York and London, has entered into partnership with Mr. G. Wallace, and they will carry on business as contracting electrical engineers, manufacturers, and vendors of electrical plant, &c., at 58, High Street, W.C. 2. Manufacturers and agents are invited to forward catalogues of every description of electrical apparatus.

Messrs. Bulpitt & Sons, Ltd., have acquired the business of Messrs. Clarke & Clarke, Hockley, Birmingham, including rights of the Clarke & Clarke diamond transformers, the sole manufacture of which they will undertake. All communications should be addressed to Messrs. Bulpitt at Swansea Works, Camden Street, Birmingham.

Mr. G. V. Twiss, M.I.E.E., who has for the past ten years been technical adviser to Messrs. Bullers, Ltd., and who founded the high-tension department of that firm, has now founded a new company—Twiss Engineering and Electric Transmission, Ltd.—whose head offices are at 62-63, Queen Street, London, E.C. 4. Mr. Twiss has been closely connected with the design and supply of material for many of the most important recent transmission lines up to 100,000 volts and the like, and much of this work was referred to in his paper "High-Tension Overhead Transmission Lines," which he read before the Institution of Electrical Engineers in 1917 (awarded the Ayrton Premium). The new company will specialise in high-voltage equipment, including lightning arrester gear, choking coils, and air-break switches; insulating and isolating gear for indoor and outdoor sub-stations, and all overhead transmission line requirements, including poles, insulators, and the like up to the highest voltages, with special regard to relative co-ordination of such material and the transmission scheme as a whole. The company has an affiliated works at Mildmay Park, N.

Messrs. Norrington and Landon, who for many years represented Messrs. Veritys, Ltd., in the North-Western area, have resigned their positions, and are forming a company, which is in process of registration, as Norrington & Landon, Ltd., with offices at 33, Brazennose Street, Manchester, and works at Dewsbury. They are specialising in engineering plants as affecting collieries, shipyards, mills, and the like.

A Canadian Trade Inquiry.—Our Canadian correspondent writes, under date April 8th:—"I have just received a letter from Messrs. Powley & Townsley, Excelsior Life Building, Toronto, stating that they would like to take up British agencies for storage battery and trolley type electric locomotives of from two to fifteen tons weight, in gauges from 18 in. up to standard railway gauge. They are also anxious to get into touch with makers of rotary converters in capacities from 2 to 25 kw., for operation on single and three-phase 25 to 60-cycle circuits for battery charging purposes. The letter referred to states that the writers would be very glad indeed to get into touch with any British manufacturers of such equipment, since they are specialising on industrial transportation. They add, that at the present time there is a very bright outlook for the sale of the foregoing equipment. The references offered by the firm are as follows:—The Bank of Ottawa, Toronto, and also the principals for whom the firm is at present acting in Canada, viz., the Edison Storage Battery Co., of Orange, New Jersey, and the Automatic Transportation Co., of Buffalo, New York. I shall be glad if you can give this matter some publicity in your columns."

Liquidations.—Blackwall Engineering and Welding Works, Ltd., Millwall, E.—At the first meeting of the creditors and shareholders, held on April 25th at the Board of Trade Offices, Lincoln's Inn, W.C., it was resolved to leave the liquidation in the hands of the Official Receiver. Particulars of the failure appeared in our last issue. Appended is a list of the principal creditors:—

	£		£
Brown Bros., Ltd., London ..	462	Poplar Boro' Council, London	428
British Oxygen, Greenwich ..	140	Palmer, Sutton & Co., London	35
Buck & Hickman, Ltd., London	54	Siemens Bros., Ltd., London ..	69
Botwood, W. J., London ..	12	Shelley, Ltd., R. T., Birmingham	36
Clark & Sons (Hull), Ltd., G., Hull	25	Siemens Bros. & Co., Ltd., Woolwich	25
Crabtree, Ltd., S., Todmorden	157	Steel, G., London	14
Calman & Sons, J., London ..	32	Sugarman, J., London	10
Cook, W., London	29	Sugarman, P., London	10
Dixon & Head, Ltd., London ..	24	Fully secured creditors	104
Hadfields (Merton), Ltd., Mitcham	17	J. Summers & Sons, Ltd., London (security valued at £134)	265
Imperial Light Co., London	15	Preferential claims	94
Langston, Jones & Samuel Smith, Ltd., London ..	22		
Norman Hopper, Ltd., London	11		

Standard Cable Manufacturing Co., Ltd.—First and final dividend of 20s. in the £, payable on and after April 28th at Carey Street, W.C.

Catalogues and Lists.—British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Special publication No. 7,747, entitled "Electric Winders." This is a very fine production containing some 50 odd sheets of photographic illustrations showing some of the principal electrically-driven winding engines or equipments that have been or are being installed by the company. It is pointed out in the opening notes that electrically-driven winding engines are rapidly replacing steam winders in all countries, and work that the British Westinghouse Co. has executed in this direction in England and Wales, and South Africa, is well represented in the book. Diagrams of connections of the Westinghouse plants appear at the end, also performance curves of various designs of winders.

British Central Electrical Co., Ltd., 6 and 8, Rosebery Avenue, London, E.C.—Eight-page price list of metal-filament lanterns for shop window and other lighting, reflector fittings, electric glue pots, boiling plates, hand lamps, c.i. watertight switches, and other accessories.

Book Notices.—*The Engineer's Year-Book for* 1919. Compiled and edited by H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 25s. net. Pp. 2,202 + cvi; 2,000 figs.—The Year-Book is now in its twenty-sixth year; it is four times the size of the first issue, and appears to be approaching the extreme limit of corpulence, though the additional pages of text this year only number 100 odd. Yet there is a long list of sections which are new or have been re-written for the present issue, amongst which we note "Clays and Allied Products used by Engineers," by Mr. A. B. Searle (including ordinary and refractory bricks, electrical ware, &c.); "Cranes and Crane Appliances," by Mr. J. H. Huntley; "Fuels: Solid, Liquid, and Gaseous," by Mr. H. Moore; and "Pulverised Coal," by Mr. L. C. Harvey. Before the mass of information contained in these thousands of pages could be adequately reviewed the next edition would be due; but, fortunately, it is not necessary to review a work of such tried and proved merit—the appeal to past experience serves to guarantee the worth of its contents, which cover an extraordinarily wide range of subjects, and replace a whole shelf of text-books. In future, we presume, the Associate Editors (over 50 in number) will have to give special attention to excision, in order to make room for new matter—and the question what to leave out, where all is worthy of retention, will be a difficult problem indeed.

Decimal Coinage. London: The Decimal Association.—In this pamphlet the advantages of decimal coinage are set forth, with special reference to the pound-mil system; the impracticability of universal coinage is explained, and the pound-mil system is described, with illustrative examples of its use. Reasons are given for making the change immediately, and arguments are advanced against the adoption of the dollar system.

The British Dominions Year-Book, 1919 (edited by Messrs. E. Salmon and J. Worsfold; London: Eagle, Star, and British Dominions Insurance Co., Ltd., price 1s.), though prepared during the war, and therefore somewhat hampered by circumstances, contains a remarkably varied and interesting series of articles and a mass of general information. Lord Leverhulme writes on "Comradeship in Industry." Mr. Archibald Hurd, and other specialists, on "The Fourth Year of War," Mr. E. Oliver on "The Truth About Japan," and there are articles on finance, trade, coal, oil, &c. Mr. Charles Bright, F.R.S.E., deals with the "Development of Inter-Imperial Communication." Altogether the Year-Book is a very successful production, and remarkable value for the price.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 4. April, 1919. New York: The Institute Price $1.

"Electrical Phenomena in Parallel Conductors." Vol. I: Elements of Transmission. By F. E. Pernot. Pp xii + 332; 82 figs., 1918. London: Chapman & Hall, Ltd. Price 18s. 6d. net.

"Principles of Radiotelegraphy." By C. M. Jansky. Pp. ix + 242; 179 figs. London: Hill Publishing Co., Ltd. Price 8s net.

"*Proceedings* of the Electrical Association of Australia." Vol. III. 1916-1917. Melbourne: The Association.

"Glasses for Protecting the Eyes from Injurious Radiations." By W. W. Coblentz and W. B. Emerson. (Technological Paper of the Bureau of Standards.) Washington: Government Printing Office. Price 10 cents.

"Annales des Postes, Télégraphes et Téléphones." 1918. Paris: A. Dumas. Price 14 fr.

Bankruptcy Proceedings.—F. J. Earle, electrician, Truro.—First meeting May 6th; public examination May 13th, both at Truro.

Electric Lamp Manufacturers' Association.—We understand that the Electric Lamp Manufacturers' Association of Great Britain has been registered as a company, limited by guarantee. The initial number of members is not to exceed 20, each liable for £100 in the event of winding up. The objects are to promote and protect the interests of manufacturers of and dealers in electric lamps in the United Kingdom, to carry on research work for improving electric lamps, to enter into agreements with members and wholesale and retail dealers in electric lamps, relating to the manufacture, supply, and sale of such lamps, &c. The first members of the Council of Management are:—W. W. Blunt, sales director, British Westinghouse Electric and Manufacturing Co., Ltd.; H. W. Cole, secretary, Stearn Electric Lamp Co., Ltd.; W. Crawford, director of "Z" Electric Lamp Manufacturing Co., Ltd.; M. V. Ely, managing director, Foster Engineering Co., Ltd.; J. Y. Fletcher, director, General Electric Co., Ltd.; H. C. Levis, chairman and managing director, British Thomson-Houston Co., Ltd.; E. A. Marx, sales manager, Pope's Electric Lamp Co., Ltd.; W. Rutherford, managing director, Dick, Kerr & Co., Ltd.; C. W. Sully, manager lamp department, Siemens Bros. Dynamos Works, Ltd. The registered office is at 46, Queen Victoria Street, E.C.

The Industrial Future.—Lieut.-General Sir Edward Bethune, K.C.B. (Chief Organiser), and Mr. T. Ernest Jackson (Trade Union and Labour Organiser), of the National Alliance of Employers and Employed, will address joint conferences of representatives of employers and delegates from Trade Unions at Newport (Mon.), on May 5th; at Grantham, on May 8th; at Oxford, on May 13th; at Dudley, on May 14th; at Lancaster, on May 19th; at Bedford, on May 20th; and at Salisbury, on May 30th. The subject of discussion in each case will be "The Industrial Future." The National Alliance is aiming at forming joint committees of Employers and Trade Unionists for the purpose of harmonising the relations between Capital and Labour. New Committees are being formed every month in the large industrial areas, and in several cases industrial disputes have been avoided or shortened by the activities of these local committees. Already 23 committees have been formed in the chief industrial centres.

LIGHTING AND POWER NOTES.

Aberdare.—Proposed Bulk Supply.—The U.D.C. has decided to approach the Powell Duffryn Co. as to the terms upon which it would supply electricity to Cwmbach and Cwmaman.

Aberystwyth.—Proposed Municipal Purchase.—The Corporation is considering the question of purchasing the electricity works, and it is proposed to utilise the water power of the River Rheidol to provide increased power.

Armagh.—E.L. Scheme.—The T.C. held a meeting on April 25th, at which Mr. J. J. Woods, electrical engineer, Clones, was present, to discuss the advisability of lighting the town with electricity. It was decided to put in an installation, and to offer a prize of £25 for the best scheme, the prize winner to be appointed consulting engineer. Mr. J. J. Woods was appointed to go into the details of the various schemes submitted.

Australia.—Queensland.—Water Power.—The State electrical engineer, Mr. W. Corin, has prepared a report on the possibilities of the hydro-electrical development of the Clarence River. The report states that 100,000 H.P. can easily be obtained, and delivered at 0·2d. per unit. A preliminary estimate of the cost of the scheme shows that the expenditure would be approximately £240,000 for 600 KW., or £40 per KW. of maximum demand, and a bulk supply cost of one-fifth penny per unit. By extending the dam, it is estimated that 100,000 H.P. could be obtained.—*Commonwealth Engineer.*

Ayr.—Proposed New Plant.—The electrical engineer has recommended the T.C. to install a rotary converter, at an estimated cost of £3,500.

Battle.—E.L. Scheme.—Messrs. Newbery Bros., Ltd., have informed the U.D.C. that if it does not soon act in reference to the E.L. scheme they will be obliged to install their own plant.

Blackpool.—Year's Working.—There was a loss of £2,721 on the working of the Corporation electricity undertaking during the past year, compared with a surplus of £8,083 in the preceding year. The receipts were £58,171, against £59,647, of which interest and debt redemption absorbed £19,991.

Price Increase.—The Electricity Committee has decided to advance the charges for electricity from 15 per cent. to 33⅓ per cent. on pre-war charges.

Bray.—L.G.B. Inquiry.—Mr. A. D. Price held an inquiry, on the 24th ult., into the application of the U.D.C. for sanction to borrow £5,000 for extensions to the electricity undertaking. The town clerk stated that the Council had had to refuse many applications for power. The engineer, Mr. W. J. Sowter, advised the installation of an additional 135-KW. Diesel-alternator set, four transforming centres, and supplementary cables.

Brighton.—Proposed Price Increase.—The T.C. has decided to apply for permission to increase the maximum charge for electricity from 7d. to 8d. per unit. It is also proposed to advance the price of energy supplied to the tramway department from 1·75d. to 1·9d. per unit.

Bury.—L.G.B. Inquiry.—An L.G.B. inquiry was held last week into the T.C.'s application for sanction to borrow £94,000 for the purposes of the electricity undertaking. The town clerk asked that the sum be amended to £97,126, the additional amount having been incurred in respect of buildings. In 1914 extensions were contemplated and provisional sanction was obtained, but the work was suspended. Colonel T. C. Ekin, who conducted the inquiry, said the L.G.B. fully recognised the difficulties, and had adopted the policy that if it was satisfied as to the necessity of the work, it gave a general approval, and deferred definite sanction until tenders had been accepted. The borough treasurer suggested that it would be a good thing if the L.G.B. would consolidate the different periods of repayment.

Canada.—Water Power.—On April 25th, the Minister of Railways stated that the Government was preparing plans for the development of the water-power of the St. Lawrence River. It is expected that 2 million H.P. could be developed, which it is proposed to use for the electrification of the railways. Negotiations are to be opened in Washington on the subject.—*The Times.*

Carnarvon.—County Hall Lighting.—The Carnarvonshire Joint Police Committee has adopted a scheme for the installation of electric lighting, &c., at the County Hall.

Continental.—Italy.—Water Power.—There are great expectations in Italy of saving in the national consumption of coal, particularly in railway traction and industry, by the use of untapped sources of water power. The President of the Higher Council of the Water Commission recently stated that projects, involving the production of some three million nominal H.P., have been examined by the Commission; and the question arises as to how far it is the duty of the State to co-operate in the promotion and the profits of such work. Almost all the water-courses which could be easily employed have already been adapted, and the only favourable openings are the rivers in the neighbourhood of a close network of railways which has hitherto hindered water-power development; most of the new projects would require very large capital expenditure for reservoirs, and the profits would in many cases be doubtful. It would be difficult to sell large supplies of power in the most fertile areas, since, with the exception of Southern Italy and the islands, not much remains to be done in the way of the application of power for electric lighting and small motor use, only the application for big electrochemical plant remaining available. Some of the plant suggested in which electrical energy is only applied for the production of heat, would, in his view, be so costly that the same heat could be obtained more economically by the use of coal at 300 lire per ton. As to electrochemical applications, electricity for such purposes could not be produced sufficiently cheaply, except where part could be sold at satisfactory prices for lighting or small motor power.

Electric traction remains to be considered, as being the only application in which electricity can replace coal; and here it is not the want of electrical power which hinders electrification, but the financial difficulty of applying the change to more than 2,000 kilometres of the railway system. Even if this use of power were doubled or trebled not more than 4 or 5 per cent. of the energy proposed to be generated would be absorbed for several years.

His general conclusion would appear to be that, while there are cases where the public advantage demands the extension of water-power schemes, even if unlikely for the present to be remunerative, the State will have to assume a share of the capital expenditure and the profit or loss. But nothing suggests that, if coal can be obtained at a reasonable cost, there will not be a sufficient demand in spite of all the electrical developments of a good number of years to come.—*Board of Trade Journal.*

The Government has announced its intention to grant subsidies to undertakings which are in a position to install electricity undertakings to supply agricultural industries and machinery in the Agro Laziale, or between the Lake of Burano and the Lake of Fondi. The schemes are to be ready within one year of the signing of Peace. The subsidies to be granted will amount to 60 per cent. of the cost of H.T. transmission lines and 50 per cent. of the cost of the distribution stations. The outlay is limited to one million lire.

Spain.—Concessions have been granted for the installation of plant to utilise the water power of the River Muga at Figueras, the River Ason at Ruerga (Province of Santander), and the River Carril at Terraso (Zamora) for the generation of electricity.

Germany.—The Berlin Electric Light and Power Co., which has a capital of 30,000,000 marks, closed the year 1917-18 with a loss of 78,833 marks. The net profits for the previous year were 1,644,611 marks, at about which figure they have remained during the war, although for the year 1912-13 the profit made was 2,593,475 marks. Last year 1,800,000 marks had to be written off on foreign holdings, principally Russian, the Russian Government having appropriated the company's concerns in that country. Full reports relating to the works in overseas countries had not come to hand. The Compania Pevillana de Electricidad is constructing an additional hydro-electric power station at Guardioro, the share capital being increased from 4,000,000 pesetas to 20,000,000 pesetas for this purpose. The Societa Elettrica Riviera di Ponente has also increased its capital to 110,000,000 l. in order to extend its area and acquire the majority of the shares in the Officine Elettriche Genovesi, which supplies Genoa and its environs with electrical energy. In addition to its share capital, the Berlin Electric Light and Power Co. has debentures issued for 36,140,000 marks.

Holland.—A company, to be called the Provincial and District Electrical Co., is to be formed to generate and distribute electricity over the whole of North Holland. Only public bodies can become shareholders in the concern—in this case the province of North Holland and the towns of Amsterdam and Haarlem—and these bodies will be supplied with energy at cost price, to be distributed by the separate bodies. The capital of the concern is to be 30,000 gulden.—*Board of Trade Journal.*

Sweden.—Among the new companies formed for the utilisation of water power in the generation and distribution of electricity is the Backs Kraft Aktiebolag, organised at Sunne, with a maximum capital of £16,700.

Croydon.—Proposed Extensions.—A report of the Electricity Committee states that its plant is insufficient to meet the demand in the near future, and that, owing to the age and diversity of the plant, it is uneconomical in working. The present plant consists of 12 sets of varying capacity. The Committee has been advised that, unless a bulk supply can be economically purchased, it should at once install two 5,000-KW. generators. The B. of T. has advised the Committee to apply to the L.G.B. for a loan for the new plant, as a satisfactory supply in bulk is not available. The estimated total cost of the extensions is £122,000

including two 5,000-KW. turbo-alternators and pumps, £70,000; three 1,000-KW. rotaries and transformers, £13,500; nine 500-KW. rotaries and transformers, £5,500; switchgear for rotaries, £8,000; static transformers, £3,000; piping, £7,500; and cooling tower, £2,000. It is estimated that, after meeting the increased capital charges, an annual saving of £8,458 will be effected, and the capacity of the plant will be doubled. It was agreed to apply for a loan.

Crowle (near Doncaster).—E.L. SCHEME.—Notice has been given that at the next meeting of the U.D.C. the question of the adoption of an electric lighting scheme will be brought up.

Devon.—WATER POWER.—The scheme for utilising the water powers of Devon for an electricity supply includes the laying of mains to connect up the following principal towns with the plant, says the *Engineer*:—Brixham, Buckfastleigh, Bovey Tracey, Chagford, Crediton, Dawlish, Dartmouth, Exeter, Exmouth, Horrabridge, Ivybridge, Moretonhampstead, Newton Abbot, Okehampton, Plymouth, Tavistock, Torquay, Totnes, Teignmouth, and Topsham. The system of mains is to be such that in practically all cases alternative lines are provided to safeguard the supply against temporary breakdowns.

Dewsbury.—PRICE INCREASE.—The Electricity Committee has increased the price of electricity for lighting purposes from 25 to 35 per cent. over pre-war rates; to rateable-value consumers from 30 to 40 per cent., and for power and heating purposes from 50 to 60 per cent.

Dundee.—PROPOSED LOAN.—The Convener has ruled that the application of the Electricity Committee for sanction to borrow £250,000 in connection with the proposed new generating station at Carolina Port is not in order until the scheme has been approved by the T.C.

Formosa.—WATER POWER.—The British Consul at Tamsui states that the hydro-electric works at Dakusui-Kei are estimated to cost nearly five million pounds sterling, and are expected to produce 130,000 H.P. (maximum 80,000 KW., average 56,000 KW.), with an easy extension of 55,000 H.P. at a further station, giving if necessary 185,000 H.P. (maximum 114,500 KW., average 80,000 KW.). The scheme is to swell the waters of Jitsu-getsu-tan (Lake Candidius) by turning into it water from the upper course of the Daku-sui-kei (River) from the vicinity of Shimai-gahara, a distance of about 15½ miles.

The average depth of the lake is 12 ft.; the average capacity of water is 660,000,000 cb. ft. Dams will be required at four places. The extra depth of water in the lake to be attained by the scheme is 75 ft., producing with the increased area of the lake an extra capacity of about 5,000,000,000 cb. ft. of water. The lake when raised will be able to give out 900 cb. ft. of water a second (maximum 1,300 cb. ft.), which will feed a large power station by the Suiri-kei (River). With an effective fall of 1,085 ft. it is estimated that 130,000 H.P. will be obtained. If necessary a further fall of 465 ft. can be arranged to the base of Mt. Taihei, which will yield an extra 55,000 H.P. In the course of this construction 65·9 miles of light railways will be worked, together with 9 miles of wire rope transportation. A subsidiary power station (2,500—3,000 H.P.) for constructional purposes is planned at the Nanko-kei River.—*Board of Trade Journal.*

Highley (Bridgnorth).—E.L. SCHEME.—At a meeting of the Parish Council a scheme was brought forward for the lighting of the village with electricity at a cost of £5,000. The matter is to be discussed at a later meeting.

Hull.—PROPOSED EXTENSIONS.—In a report on the extensions necessary in connection with the Corporation electricity undertaking, the acting engineer, Mr. J. F. Magoris, stated that on March 31st, 1914, 17,000 KW. were connected, whereas on March 31st, 1919, the load had risen to 37,000 KW. During the three months immediately preceding the war, applications for new services averaged 16 per month, whereas during the past three months the average was 66·3. The new bulk supply scheme, which includes a supply to the tramways, is estimated to result in an increased output equal to the total output of the undertaking in 1914. It is, states the report, desirable to replace the old and economical plant, and to proceed with extensions at an early date. The installation of a 10,000-KW. turbo-generator, and a large water-tube boiler, is recommended, and two other boilers are suggested. The cost of the turbine plant is estimated at £67,286, the boiler-house plant at £31,615, and the pumps and pipe work at £4,200, a total of £103,101, to which must be added 20 per cent. for contingencies, making £123,721. The proposals are to be considered at the next meeting of the Corporation.

BULK SUPPLIES.—The Electricity Committee has decided to supply electricity in bulk to the Swan Flour Mill, the Hull Ice Co., and Messrs. Priestman Bros.

India.—WATER POWER.—A new hydro-electric power plant has recently been set to work at the Kambank Mine, 60 miles from Tavay, Burma.

Keighley.—PROPOSED LOAN.—The Electricity Committee has recommended application to the L.G.B. for power to borrow £72,733, for expenditure already incurred and estimated to be required during the next two years in the electricity department.

Larkhall.—COLLIERY ELECTRIFICATION.—A new power station has been installed at Dykehead Colliery. It is three-phase 500 volts, and there are two mixed-pressure turbo-alternators of the Curtis reaction type. Each machine has an output of 400 KW., and is provided with a Westinghouse spray condenser. The air-circulating pumps are driven by a 60-H.P. motor, D.C. being supplied by a Bruce Peebles-La Cour converter, with an output of 75 KW. The Keith, Blackman fan, with a capacity of 90,000 cb. ft. of air per hour, is belt-driven by a 100-H.P. slip-ring induction motor. There are three electrically-driven pumps underground; and in No. 2 pit endless-rope haulage is all electrically operated.

Leintwardine.—E.L. SCHEME.—At a parish meeting, a Committee was appointed to consider, among other projects, an electric lighting scheme.

London.—POPLAR.—The Electricity Committee has reported that the arrangement with the Stepney B.C. for alternately closing down the electricity works during light-load periods, has resulted in a saving of 4½ per cent., estimated to be equivalent to £2,160 per annum.

N.-E. LONDON JOINT SCHEME.—A preliminary report by the consulting engineer appointed by the West Ham and Poplar B.C.'s. to inquire into a joint scheme for the supply of electricity to the N.-E. London area, has been submitted to the Poplar B.C. A Sub-Committee has been appointed to consider the report, with representatives of the other Councils concerned.

Maidstone.—PROPOSED PRICE INCREASE.—The T.C. has applied for powers to increase the maximum price of electricity from 7d. to 10d. per unit, and to extend the supply to parishes outside the borough.

Manchester.—YEAR'S WORKING.—The Electricity Committee has announced that there was a loss of £37,890 on the past year's working of the undertaking. The whole of the reserve fund of £23,636 has been placed to the revenue account, reducing the debit to £14,254.

North Wales.—WATER POWER.—The owners of the Nantlle quarries are considering the introduction of electric power. A Manchester newspaper states that the North Wales Power Co. has offered to supply electricity at 1½d. to 1½d. per unit. Surveys have been made of the district near the quarries, and it is estimated that 1,500 H.P. could be obtained.

Nottingham.—LOAN SANCTION.—The L.G.B. has sanctioned the application of the T.C. for permission to borrow £75,800 for extensions at the St. Ann's Well Road generating station.

Southport.—L.G.B. INQUIRY.—Col. T. C. Ekin held an inquiry, on April 23rd, into the application of the T.C. for permission to borrow £132,000 for electricity purposes. The Town Clerk stated that a good deal of the plant was out-of-date, and it was at present over-loaded. The application was made on the understanding that the borrowing powers were only desired provided the expenditure would not be rendered unnecessary by the Government's scheme, and the Council was willing, instead of installing new plant, to take a bulk supply if it could be supplied more economically. Mr. A. S. Black, the borough electrical engineer, stated that it was proposed to discard the existing 2,000-volt single-phase system of generation, and to install a three-phase system, at 6,600 volts, 50 cycles. The Electricity Committee had visited the Brush Co.'s works, and inspected the Brush-Ljungstrom turbine sets, and Mr. Black was satisfied that these machines were in every way reliable. The cost was estimated as follows:—Two 3,000-KW. turbo-alternators, with accessories, £52,000; switchboard, piping, &c., £8,000; 6,000-KW. transformers, £12,000; mains, £30,000; boilers, seatings, and fittings, £5,000; substation and switchgear, £2,000; capital expended in anticipation of borrowing powers, £23,000; total, £132,000. He estimated that the saving in fuel would be 50 per cent., or about 6,000 per annum under present conditions. The inquiry was closed.

Thurles (Co. Tipperary).—E.L. SCHEME.—The U.D.C. has instructed its solicitor to take the necessary steps in connection with the installation of an E.L. scheme in the town.

Templemore (Co. Tipperary).—E.L. SCHEME.—The U.D.C. has decided to proceed with the lighting of the streets with 40 50-C.P. electric lamps; the supply will be extended to private consumers, if desired.

Unsworth.—E.L. SCHEME.—Particulars have been submitted to the P.C. by the Lancashire E.P. Co. *re* the proposed electric lighting of the village, and estimates of the cost are to be prepared for the next meeting.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—TRAMWAY TRACK ARBITRATION.—The award of Sir Alex. Kennedy, in connection with the arbitration between the T.C. and the Tramway Co., with regard to the condition of the track to be taken over by the T.C. at the conclusion of the lease, directs that parts of the track be relaid with new rails, and parts with partly-used rails.

Blackpool.—YEAR'S WORKING.—During the year ended March 31st, 1919, the receipts of the Corporation tramway department amounted to £140,929, an increase of £21,590 on the previous year. The expenditure was £90,033. Interest and loan

repayments totalled £20,844, leaving a net balance of £30,052 against £31,518. Passengers carried numbered 23,279,202, an increase of over three millions, and 1,242,108 car-miles were run, a decrease of 10,770.

Canada.—RAILWAY ELECTRIFICATION.—Three hundred representatives of Ontario municipalities have requested the Government to turn over to the Hydro-Electric Commission for electrification branch lines of the Grand Trunk Railway and the Canadian Northern Railway in the province, and to co-operate with the Commission so that municipalities may acquire branch lines as necessary.—*The Times.*

Continental.—SPAIN.—The Sociedad de Tranvias Electricos de Granade has applied for a concession for the construction and working of narrow-gauge electric railways between Granada and La Zubia, and between Arnulla and Alhendin, in the Province of Granada.

Exeter.—CONDUCTRESSES.—The Corporation has decided to replace all women tramcar conductresses by youths.

Huddersfield.—WAGES.—The Tramways Committee has agreed to pay its employés double time for Sunday labour.

Hull.—FARE REVISION.—The Tramways Committee has decided to abolish the ½d. morning fares.

Keighley.—YEAR'S WORKING.—The receipts of the tramway department for the year ended March 31st, 1919, amounted to £15,229, an increase of £2,642 on the previous year. The receipts from the railless section were £3,298, a decrease of £1,310.

Liverpool.—COLLISION INQUIRY.—Reporting to the Board of Trade on an accident which took place on the Liverpool Overhead Railway on January 13th last, Lieut.-Col. Pringle suggests various modifications in the system of automatic signalling which is employed, with a view to ensuring greater safety.

London.—BREAKDOWN.—Due to the breakdown of a cart on the tramway track near Blackfriars Bridge on Thursday, last week, traffic was blocked in both directions for about an hour.

FIRE.—There was a serious outbreak of fire on Friday night, last week, at the Metropolitan Tramways Depôt, Finsbury Park, involving an extensive building used as a storehouse.

SNOWSTORM.—Following the snowstorm last Sunday evening, snow ploughs had to be used to clear the tramway tracks at Wood Green and Finchley.

The North London electric trains had great difficulty in climbing the steep gradient between Richmond and Broad Street owing to the accumulation of snow. Trains were run at intervals through the night to keep the rails free, and ensure the service on Monday morning.

Manchester.—PROPOSED EXPRESS TRAMCARS.—The Corporation's town planning scheme, which provides for three great roads into Cheshire, also makes provision for express tramcars into the city. The road devoted to this service would be protected, and railways and 'bus services would be arranged to cope with the new traffic from freshly developed districts. Specially constructed tramcars would be used for speed and comfort. In view of the present congestion of some city streets alternative routes may have to be found to deal with new traffic.

Sheffield.—STRIKE.—In connection with the interpretation of the agreement between the Municipal Tramways Association and the Transport Workers' Union, the tramway employés, on April 27th, refused to take out the cars, and called a mass meeting, to which the general manager was invited. The men refused to carry on until the Corporation met, and eventually the manager acceded to some of the demands. Work was then resumed, after a stoppage of three hours.

Spen Valley.—FARE REVISION.—The Yorkshire (Woollen District) Electric Tramways Co. has decided that, from May 1st, all penny fares will be abolished in favour of 1½d. fares, except on the Moorend route at Cleckheaton.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—The Direct United States Cable Co. announces that, as only half the rental for the past six months has been received from the Western Union Telegraph Co., payment of a dividend for the quarter to March 31st last will not be made. The main cable was interrupted on September 22nd 1917, and has not yet been repaired. Under the provisions of the lease the Western Union Co. was entitled, in the event of the main cable being interrupted for 12 months, to reduce the rent by one-half thereafter, and should the cable be interrupted for a further six months, the company had the option of ceasing to pay the rent until the cable was repaired, or of terminating the lease. The Western Union Co. has intimated that it intends to terminate the lease in consequence of the interruption. An unsuccessful expedition to repair the cable last year involved the company in an expenditure of over £70,000. The directors have taken steps to apply to the High Court for relief against forfeiture of the lease.—*The Times*

Continental Telegrams.—Private and commercial telegrams are now accepted, at 5½d. per word, for places in Latvia (Lettland) and Lithuania. Communication is uncertain, and telegrams are liable to heavy delay.

India.—The disturbances continue, and there have been reports of telegraph wire cutting in several instances. At Tanda, near Hoshiarpur, the wires have been cut; near the district headquarters at Lahore the canal wire is cut, while in the Punjab telegraph wire cutting is constant.

New Telephone Lines and Stations.—In the London district during the 13 weeks ended January 21st, 1919, 1,390 exchange lines, 2,649 internal extensions, and 391 external extensions were provided. In the same period, 700 exchange lines, 850 internal extensions, and 145 external extensions were recovered, making net increases of 693 exchange lines, 1,799 internal extensions, and 246 external extensions.

For the three months ended January 31st, 1919, the net increase in telephone exchange wire mileage in the London Engineering District was 7,656 miles, the increase underground being 8,930 miles, whilst the open (bare wire) and aerial cable decreased by 488 miles and 786 miles respectively. Telephone trunk wire mileage increased by 181 miles, underground telegraphs increased by 101 miles, and aerial telegraphs by 41 miles. Pole line decreased by 3 miles. Pipe line increased by 22 miles. The aggregate mileages in the district at the end of January, 1919, were as follows:—Line mileage: Pole line, 2,567 miles; pipe line, 3,575 miles. Single-wire mileage: Telegraphs, 17,920 miles; telephone exchange, 1,012,845 miles; telephone trunks, 17,409 miles; spare wires, 18,235 miles; exclusive of wires on railways maintained by railway companies. The total length of underground cable is 7,166 miles.

The following statistics in connection with work carried out during the war for Government Departments have been extracted from official records:—Non-multiple-type P.B.X.'s: Number provided 446; fitted capacity, 16,730; total working lines, 12,809. Multiple-type P.B.X.'s: Number provided, 38; number of sections, 323; fitted capacity, 20,910; total working lines, 16,130. During the progress of the work, numerous alterations in the grouping of the telephones were required to meet the ever-changing conditions, and in this respect great difficulty was experienced in getting the Departments concerned to specify their requirements to the Post Office early enough.—*P.O. Electrical Engineers' Journal.*

Snowstorms.—Reports of the damage by snow and gale during the week-end come from all parts of the country. Communication was everywhere interrupted. Out of 923 trunk telephone lines, 200 were brought down by the storm. Of London lines, over 11,000 are said to be affected. At noon on Monday there was no communication at all with the following places:—Bishops Stortford, Hertford, Southend, Halstead, Braintree, Hatch End, Epping, Radlett, Frinton, Witham, and Yarmouth. With the following places there was no direct communication, though they might be reached in a roundabout way: Bradford, Bournemouth, Bury St. Edmunds, Biggleswade, Cambridge, Clacton-on-Sea, Eastbourne, Harwich, Hastings, King's Lynn, Lincoln, Grimsby, Lewes, Malden, Middlesbrough, Newmarket, Newcastle, Norwich, Stevenage, Sandy, Seaford, and Uckfield. Out of 22 lines to Manchester, only 1 was working; to Leeds, 2 out of 12; to Ipswich, 1 out of 8; and to Hull, 4 out of 10. Curiously, all telephone lines to Glasgow were working. The rapid thaw did much to restore communication by removing short circuits. Considerable damage was also done to telegraph lines. On Tuesday only one line was working to Ireland, *via* Scotland, and only three from London to France.

The Post Office notifies that in consequence of interruptions caused by the snowstorm there is heavy delay of telegrams to and from the Continent.

Spain.—All telegraphists at Madrid who did not resume work by midnight on April 24th were to be dismissed and replaced forthwith by pupils of the School of Telegraphy and other applicants. The telephone service is again working normally.—*The Times.*

Only 40 telegraphists failed to respond to the demand of the Government to return to work. In consequence the appeal to people acquainted with telegraphy to offer their services during the strike was cancelled.

Underground Cables.—The Wimborne, Dorset, Urban District Council protests against the intention of the authorities to proceed with the laying of all the principal telegraph and telephone lines through the town in underground ducts.

Wireless Restrictions Removed.—With reference to our note last week, we are informed that the Marconi Co. has received notice from the Admiralty that from noon, on Thursday, May 1st, all restrictions on the use of wireless telegraphy on ships are removed except in the following waters:—North Sea; English Channel, east of a line joining Dungeness and Boulogne; Baltic; North Russian waters; Mediterranean; Black Sea; and the Sea of Marmora. On and after that date wireless telegrams intended for passengers on board ship may be filed at the offices of the company, or at any postal telegraph office in the U.K.

Wireless Telephony.—According to the daily Press, the s.s. *George Washington*, the ship on which President Wilson will travel back to the States, has been refitted with powerful wireless telephone apparatus, which, it is said, is capable of transmitting over a distance of 1,200 miles.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—BRISBANE.—June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.) from the offices of the company at Brisbane.—*Tenders.*

SYDNEY.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

June 23rd.—Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.

Batley.—May 15th. Electrical engineer's work in erection of picture house for Regent Pictures, Ltd. Messrs. W. Hanstock and Son, architects, Branch Road, Batley.

Bedford.—May 3rd. Electricity Department. Meters for 12 months. (April 18th.)

London.—L.C.C.—May 12th. 5,000 driving-wheel tires, and 3,500 trailing-wheel tires for electric tramways. General Manager, L.C.C. Tramways, 23, Belvedere Road, Lambeth, S.E.

Manchester.—May 21st. Electricity Committee. Wet air filter for the Stuart Street station. (See this issue.)

Natal.—May 20th. Corporation. 12 miles steel girder rails (95 lb. per yd.) with fishplates, bolts and nuts, and 4,300 tie bars, and 1,500 copper rail bonds and 300 cross bonds. Webster, Steel & Co., Agents to the Durban Corporation, 5, East India Avenue, E.C.

Templemore (Co. Tipperary).—U.D.C. Electric lighting installation. Mr. Thos. Kielly, Clerk to U.D.C.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Glasgow.—The Tramways Committee recommends acceptance of the following :—

Stoneware ducts.—Albion Clay Co., Ltd.
Trolley wire.—Fred Smith & Co., Ltd.
Micanite cloth.—Micanite & Insulators Co., Ltd.
Tread plates.—Jos. Billingham.
Truck frames.—J. G. Brill & Co.
Scrap for disposal.—R. M. Easdale & Co.; Philip & Bruce, Ltd.
Enamelled plates.—W. Landell.

London.—The Charing Cross, West End & City Electric Supply Co., Ltd., has placed a repeat order for four more 12-retort Erith-Riley stokers, each being applied to a water tube boiler with 10,850 sq. ft. heating surface. Each 12-retort stoker is applied to an archless furnace 21 ft. wide and has a normal capacity of 3 tons of coal hourly, continuously discharging the incombustible ash.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 2nd. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Mechanical Properties of Steel, with some Consideration of the Question of Brittleness," by Mr. W. H. Hatfield.

Royal Institution of Great Britain.—Saturday, May 3rd. At 3 p.m. At Albemarle Street, W. Lecture on "The Psychology of Industry; Essential Considerations in Business Organisation, and the Consequences of their Comparative Neglect in Modern Times," by Prof. H. S. Foxwell.

Thursday, May 8th. At 3 p.m. Lecture on "Clutches," by Dr. H. S. Hele-Shaw, F.R.S.

Society of Engineers (Inc.).—Monday, May 5th. At 5 p.m. At Burlington House, W. Paper on "Heat Treatment of Steel," by Mr. C. O. Bannister.

Institution of Civil Engineers.—Tuesday, May 6th. At 5.30 p.m. At Gt. George Street, S.W. Further discussion on papers on "The Electrical and Mechanical Equipment of the All-metal Cars of the Manchester-Bury Section L. & Y. Railway," and "All-metal Passenger Cars for British Railways."

Roentgen Society.—Tuesday, May 6th. At 8 p.m. At the Royal Society of Medicine, 1, Wimpole Street, W. Silvanus Thompson memorial lecture on "The Electrical Changes in Active Tissues," by Prof. W. M. Bayliss, F.R.S.

Industrial Reconstruction Council.—Tuesday, May 6th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Workmen as Directors," to be opened by Mr. G. H. Humphrey.

Royal Society of Arts.—Wednesday, May 7th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Supply of Electricity," by Mr. J. S. Highfield.

Institution of Electrical Engineers.—Thursday, May 8th. At 2.30 p.m. Joint meeting with the Iron and Steel Institute. At the Institution of Civil Engineers, Gt. George Street, S.W. Papers on "Electric Furnaces." See "Notes" to-day.

(South-Midland Centre).—Wednesday, May 7th. At 7 p.m. At the University, Birmingham. Ordinary meeting.

(Students' Section).—Friday, May 9th. At 7 p.m. At the City and Guilds Technical College, Leonard Street, E.C. Paper on "The Principles of Scientific Illumination," by Mr. C. E. Webb.

Society of Technical Engineers (South-Eastern District).—Thursday, May 8th. At 7.30 p.m. At Caxton Hall, Westminster. General meeting.

Junior Institution of Engineers.—Friday, May 2nd. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Engineering at the Front," by Capt. G. B. Paterson, A.I.F.

Friday, May 9th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Pneumatic Tires as Applied to Road Vehicles, and their Automatic Inflation," by Mr. R. Barnfather.

THE ELECTRICAL WHOLESALERS' FEDERATION, LTD.

On Wednesday morning members of this Federation assembled at the Trocadero Restaurant, London, for their annual general meeting. The morning and afternoon sessions were devoted to the consideration of many matters of interest to electrical factors, and, indeed, to the electrical trade as a whole. These proceedings were, no doubt quite necessarily, conducted in private, but the technical Press was admitted to the luncheon. Mr. R. Wilson Smith (Commercial Manager of Drake & Gorham, Ltd.), presided over a company which numbered over 40, including the Press. The speeches were brief and businesslike, and, as recorded here, will suffice to let electrical factoring firms of proved standing and unimpeachable integrity know what are the objects of the Federation, and that the membership books are open to receive additional names, if they desire to associate themselves with what may well become a movement of considerable importance and one of value to the electrical trade. We give below the list of members in the six districts as at April 3rd, 1919 :—

London.—*Berry's Electric, Ltd.; British Electric Equipment Co.; Dawson, E., & Co.; *Drake & Gorham, Ltd.; Electrical Supplies, Ltd.; Gillespie & Beales; Leach, S. G., & Co.; Marshall and Plumtree; *Pooley & Austin; Sloan Electric Co., Ltd.; *Sun Electrical Co., Ltd.; Vulcan Electrical and Mechanical Engineering Co.; Wholesale Electric Co.; Wholesale Fittings Co.

Lancashire (*Liverpool, Manchester, &c.*).—Atkinson, Lloyd and Co., Salford; Jackson, H. A., & Co., Salford; *Baxendale Bros., Liverpool; Dennis, E. P., & Co., Liverpool; *Downes & Davies, Liverpool; Sutton, C. A., & Co., Liverpool.

Yorkshire.—Albion Electric Stores, Leeds; Casperson Bros., Leeds; *Hallamshire Electric Co., Sheffield; Scattergood and Johnson, Leeds.

Northern District (*Newcastle and Middlesbrough*).—British Electric Manufacturing Co., Newcastle; *Electric and General Stores, Newcastle; Gledson, J., & Co., Newcastle; Grainger, T., and Co., Newcastle; Heckels, M. O., Newcastle; Miller, J. F., and Co., Newcastle; *North British Engineering and Equipment Co., Newcastle; Rawcliffe, F., & Co., Newcastle; Bell, J. T., & Co., Middlesbrough; Hanson, Brown & Co., Middlesbrough; Jarvis Bros. & Co., Middlesbrough; Mulcaster, J., & Co., Middlesbrough.

Midlands (*Birmingham and District*).—Berkeley, A., Birmingham; Bill & Berry, Birmingham; *Donovan & Co., Birmingham; Robinson & Hands, Birmingham; Electrical Stores, Nottingham.

Scotland.—Cartwright, J., Glasgow; Miller & Stewart, Glasgow; *Paterson & Service, Glasgow.

*Members of the Committee.

Secretary: Mr. A. G. Beaver.
Offices: 118-120, Charing Cross Road, London, W.C.

We may mention here that one of the standing rules with which all members of the E.W.F. have to comply before joining is that they must purchase and carry stocks on their own account for supplies to electrical contractors, &c., further, they must not cater for the retail trade, and must not have any contracting (wiring) interests.

Mr. Smith, in proposing "The Electrical Wholesalers' Federation," said that the Association germinated in 1914, and became an incorporated body in 1915. Everyone would agree in these days of powerful combines that it was necessary that they should have a representative Association such as that, for pooling interests, and for their protection.

There was no need for him to dwell on the usefulness of a genuine factor who carried large and varied stocks, both to the manufacturer and to the contractor. As one American writer had put it :—"We are expected to give prompt and infallible service, interpret orders which would require a Sherlock Holmes to understand what is wanted, often take back goods which have been ordered in excess, and give the full credit demanded—in fact, act as warehouse, stockroom, shipper, and, in many cases, banker as well."

They did this, relieving the manufacturers of the necessity of carrying large stocks throughout the country, minimising their risk of bad debts, and, in fact, acting as general distributing agents at a percentage, in many cases, much less than their own selling charges.

The activities of the Federation had necessarily been affected during the period of the war, although the Committee had done a large amount of ground work, and on several occasions had been able to bring about a better understanding between the manufacturer and the factor. They felt that the time had now come when by means of Main and Local Committees, meeting at regular intervals, they should be able to achieve results which would be beneficial to the industry as a whole. Mr. Smith coupled with the toast the name of the indefatigable secretary, Mr. Beaver, who had done more work than anyone else in putting the Federation on its present footing.

Mr. Beaver, in responding, said that he had the work very much at heart. They started just before the war in a small way, but the outbreak of war considerably nullified their efforts, as it dis-

organised a good many businesses. Notwithstanding the difficulties, they continued to endeavour to make headway. He was more than gratified to see that out of a total membership of 44 they had at least 36 present. That was a very good percentage and a very good omen. Obviously the members of the Federation had its interests at heart. In these days of Trade Unions and combinations of all sorts it was very essential that an industry like the wholesale electrical industry should have its own Association. It had a large number of interests to look after, and it needed protection, which could only be secured by binding themselves together in some way. Some years ago they felt the need of some such organisation, because manufacturers appeared to have a tendency to eliminate the factor wherever they could. If the factor was in a large way, and could command good business, the manufacturer would come along and solicit his orders, and then he had a happy knack of going round to the nearest contractor, or trade user, perhaps, and selling on exactly the same terms as when he secured the factor's large order. It was to do away with that state of things that the E.W.F. was brought into being. The efforts that the main Committee had made had been the means of promoting a better understanding with manufacturers than ever they had before. When the members got together they found that they were not such bad fellows, after all. At one time they used to think their competitors were their natural enemies. Now that they were meeting one another and interchanging views, the industry as a whole was benefited. There was no use in the senseless price-cutting which went on, and by meeting together they could see how it could be prevented. It meant that they got the same business—there was room for everybody—and they could get it at a better price than before. Mr. Beaver concluded by issuing an invitation to other genuine wholesale factors to join their ranks.

NOTES.

Royal Arch Masonry.—On April 8th, Mr. P. Colville Smith, Grand Secretary and Scribe, consecrated the Kelvin Chapter, which will be attached to the Kelvin Lodge, No. 3,736, which is composed of electrical engineers. The ceremony took place at Mark Masons' Hall, W.C., and the other Grand Chapter officers assisting were Mr. Percy Still, P.P.G.Soj.; Canon C. W. Barnard, Grand Superintendent, Warwickshire; Mr. C. F. Quicke, P.A.G.Soj.; and Mr. A. Ransford Collett, D.G.D.C. Mr. V. Delebecque, Mr. E. J. Reid, and Mr. J. O. Pearston were installed as the first Principals, and Mr. H. Porter-Cox was appointed secretary.

The Incorporated Municipal Electrical Association.—ANNUAL CONVENTION.—The Convention will be held this year at Felixstowe on June 17th-19th, and we have received a copy of the programme, which indicates a return to pre-war amenities. Headquarters will be at the "Felix" Hotel, Felixstowe; the meetings will take place on June 17th at the Town Hall, Ipswich, and on the following days in the Spa Pavilion, Felixstowe. Papers and reports will be taken as read. On Tuesday, June 17th, the Mayor of Ipswich will receive the Association, and Mr. F. Ayton (engineer and manager, Ipswich Corporation electricity supply and tramways) will deliver his presidential address, after which Ald. W. Walker will read a paper on "The Whitley Report." In the afternoon there will be visits to various works, followed by afternoon tea with the Mayor, and in the evening, dinner at Felixstowe. After dinner a special meeting of "Committee" members of the Association will consider the question of the salaries of chief electrical engineers in the light of the scale formulated by the Associated Municipal Electrical Engineers. On Wednesday morning at Felixstowe Mr. S. L. Pearce will open a discussion on "Electric Transmission Considerations," and a paper on "The Rating of Electric Supply Undertakings" by Bailie W. B. Smith, of Glasgow, will be read and discussed. In the afternoon the seaplane station will be visited, and in the evening the annual dinner will be held. On Thursday morning the annual general meeting will take place, followed by a special general meeting with regard to the alteration of the articles of association. Communications should be addressed to the president of the Association, Corporation Electric Supply and Tramways Departments, Ipswich.

Dissension in the E.T.U.—According to the Manchester *Daily Dispatch*, serious internal trouble is threatened in the Electrical Trades Union in consequence of the action of the Executive Council in granting strike benefit to members in the Thames, Belfast, Clyde, and Forth areas, who came out on strike without official sanction, and against the advice of their union, during the Belfast and Clyde strikes.

The action of the Executive Council is to be put to the vote on the appeal of the Newcastle Central Branch, who consider the action of the executive on February 2nd a gross violation of the rules by which a ballot must be taken before a strike can receive sanction.

"We most emphatically deplore this dangerous precedent as unconstitutional, unjust, and certainly not democratic (they state). . . . If this dangerous and autocratic precedent is allowed to pass unchallenged it will deprive members of the only safeguard they have within the union whereby they may counteract irregular and irresponsible handling of funds. Should this precedent become an accomplished fact it will place members at the mercy of the extremist and the irresponsible and will end in bankruptcy and chaos."

Ballot papers have been circulated throughout the union, on which members will vote for or against the appeal.

Educational. — AERONAUTICAL ENGINEERING. — The Aeronautical Institute of Great Britain has inaugurated an intensive Course in Aeronautical Engineering at the Institute of Marine Engineers. A well-attended Course started on April 14th, and a new Course is being arranged to commence very shortly.

Eclipse of the Sun.—Observations will be made by special British and American expeditions in South America, the Atlantic, and Africa of the total eclipse of the sun, which occurs on May 19th. Magnetic and electrical observations will be made at Cape Palmas, Liberia. Special attention should be given by wireless operators to any peculiarities in the transmission of signals at the time of the eclipse. It is important to ascertain whether there are any effects on signal strength due to the passage of the moon's shadow over a station, such as accompany the daily passage of the earth's shadow at sunrise and sunset.

Fatalities.—While assisting to clean out a boiler at the Hill Crest Oil Works, Clayton, John Robertson (17), a labourer, received a fatal shock from an electric bulb. It was stated at the inquest, at Manchester, that Robertson was holding the bulb by the joint at the top. He had done so for about a quarter of an hour when the boilerman, whom he was assisting, spoke to him without receiving a reply, and found that he had died as if going to sleep, without making a sound. Medical evidence was that death was due to heart failure following an electric shock (240 volts A.C.). The inquiry was adjourned for H.M. Inspector of Factories to make an examination.

At the resumed inquest on Monday, Mr. Henry Topham, Electrical Inspector, said he had examined the scene of the accident. Deceased had been cleaning out a boiler flue, and using a portable electric lamp attached to a cable. He had carefully examined the lamp, and found that the locking-ring connecting the two parts of the lampholder was slack. On one side the stranding which prevented the spring contact from touching the metal sleeve of the lampholder was broken away. The result was that it was quite easy for the terminal to touch the metal work of the lampholder. The whole thing would then become charged at 240 volts. The deceased, while holding the lamp, made good contact with the damp earth, and he would receive such a shock that death would be instantaneous. The lamp looked as if it had been improperly wired by someone who did not understand it. A representative of the firm explained that candles were provided for the class of work that the deceased was engaged upon, and it was against instructions for anyone to use the portable electric lamp. A verdict of "Accidental death" was returned.

It is stated that Patrick Dillon (33), while working a coal-cutting machine in Easterhill Colliery, Tollcross, received a fatal electric shock.

Whilst fixing an electric cable in a house at Bethnal Green, Thos. Carter (36), in the employ of the Stepney B.C., was killed through touching the cable which was apparently alive. The inquest was adjourned.

On April 25th a Post Office telegraph lineman fell from a pole 80 ft. high in Boyle Street, London, and was killed.

Electric Vehicle Committee.—At the request of the Executive Committee of the Association of British Motor and Allied Manufacturers, Mr. F. Ayton, M.I.E.E., hon. secretary of the Electric Vehicle Committee of Great Britain, has consented to read a paper on Electric Vehicles at the Royal Automobile Club, at 8.15 p.m., on Wednesday, May 14th.

The primary purpose of this paper, and of the discussion which will follow it, is to encourage the manufacture, in this country, of electric vehicles, and of the various components, accessories, and apparatus, required in connection with the construction, use, or charging of electric vehicles. It is hoped that the meeting will be attended by all who are interested in this important subject.

Tickets may be obtained from:—The General Secretary, Association of British Motor and Allied Manufacturers, Ltd., 39, St. James's Street, S.W. 1; or from Mr. F. Ayton, Corporation Electrical Supply and Tramways Departments, Ipswich.

Appointments Vacant.—The Council of the British Scientific Instrument Research Association (26, Russell Square, W.C. 1) is about to appoint an Assistant Director of Research at £1,000 per annum. Applications must be received by the Secretary by May 21st.

Electrical engineer and manager (£800), for the West Ham Corporation Electricity Department; charge engineer (84s.), for the Bath Corporation Electricity Works; shift engineer (97s. 6d.), for the Ealing B.C. Electricity Supply Department. See our advertisement pages to-day.

Plant Life and Wireless.—Sir J. C. Bose, of the Presidency College at Calcutta, announces that plant life receives and responds to the long ether waves used in wireless signalling. This great Indian scientist announced four years ago that plants were intoxicated by alcohol, wearied by too much work, and stung by blows.

Workmen's Compensation Claim.—In the City of London Court, on April 28th, before his Honour Judge Atherley Jones, K.C., the case of Gamble *v.* National Steam-Car Co., Ltd., was mentioned under the Workmen's Compensation Act. Plaintiff, Herbert D. Gamble, electrical engineer, 3, Cornwall Terrace, Regent's Park, claimed against the defendants, 16, St. Helen's Place, E.C., compensation for very serious injuries which had occurred to him while working for them, his salary being £300 a year. Mr. Tristram Beresford, plaintiff's counsel, said that the accident happened on August 28th when Gamble was at Chelmsford carrying out certain tests with a coal calorimeter. There was a little test glass on it. That exploded and wounded the plaintiff very badly in the face, and destroyed his eyesight. Defendants did not pay any compensation straight away, but now they consented to pay him all he could claim, viz., 25s. a week from August 31st to the present time, and to continue during his total incapacity. The Court directed an award to issue in accordance with those terms.

The Society of Technical Engineers.—Although the existence of this new Society has for many months been a matter of common knowledge, the promoters have not courted publicity, preferring to complete their organisation before coming into the open. The first public appearance of the Society, in fact, was at the Industrial Conference on April 4th, when, as already reported, the general secretary applied for representation of the Society on Joint Industrial Councils, including the National Industrial Council.

The formation of the Society was first proposed towards the end of 1917, when a number of informal meetings of engineers were held to consider the position of engineers under the new conditions created by the war. The first formal meeting was held in February last year, when representatives of a large number of engineers attended, and a provisional National Executive Council was formed. The movement was taken up with enthusiasm in all parts of the country, as it was recognised that the managing class was the only class of industrial worker still without an organisation, the first essential to effective action on behalf of the members of that class. Thousands of men are eligible for membership, and there is no sign of opposition to the movement. It is not intended that the Society shall replace existing scientific institutions, though it will endeavour to further the technical as well as the material interests of its members.

The whole of the present organisation, though it has been elaborated and developed widely, is of a provisional nature; when the draft constitution and rules of the Society have been approved, it will proceed to the formal election of council and officers. In the meantime a salaried general secretary, Mr. Norman Wyld, has been appointed, with offices at 25, Victoria Street, S.W. Besides affording opportunities for intercourse and the exchange of ideas between the members, the Society will stimulate the diffusion of technical knowledge, promote education and training, and endeavour to secure for engineers a more adequate recognition of the services they render to the community, as well as a larger share in the control of their working conditions. The qualifications for membership have not yet been defined with precision, but will be designed to make membership a guarantee of professional qualification. Probably the Society will be registered as a trade union.

Institution and Lecture Notes.—The Institution of Electrical Engineers and the Iron and Steel Institute.—The following are the papers which are to come before the joint meeting of these two bodies at the Institution of Civil Engineers, Great George Street, Westminster, S.W., on Thursday, May 8th, at 2.30 p.m.:—

J. Bibby, "Developments in Iron and Steel Electric Furnaces."
W. K. Booth, "The Booth-Hall Electric Furnace."
H. A. Greaves, "Application of Electrical Energy to the Melting of Metals."
R. G. Mercer, "Electric Furnaces in the United Kingdom, 1918."
Axel Sahlin, "A New Type of Electric Furnace."
Victor Stobie, "Large Electric Steel-Melting Furnaces."

Will our readers kindly take special note of the time of this meeting?

INFORMAL MEETINGS.—The next informal meeting will be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to 335, High Holborn, W.C., on Monday, May 12th, 1919, at 7.30 p.m., when Mr. W. E. Bradshaw will open a discussion on "Regulations Issued by Electricity Supply Undertakings."

Illuminating Engineering Society, U.S.A.—The 1919 Convention of the Society will be held in Chicago, Illinois, as early in October as possible. Further details will be issued as soon as definite plans are formulated.

Institute of Metals.—The spring and autumn meetings of the Institute will be held respectively in London on May 19th and in Sheffield on September 24th and 25th. At the former, Prof. F. Soddy, F.R.S., will deliver the ninth annual May lecture, on "Radio-Activity," for which cards of invitation may be obtained from Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W. 1, upon receipt of a stamped and addressed envelope. The Sheffield meeting will be the first provincial gathering of the Institute to be held since the outbreak of war. There will be visits to works and other functions besides the ordinary business. Those desirous of participating in the Sheffield meeting should communicate at once with Mr. Shaw Scott.

Electrical Association of Australia (Victorian Section).—At a meeting held at Melbourne on March 27th, a discussion on "Automatically-controlled Sub-Stations and Power Stations" was opened by Mr. G. G. Oree.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Southampton T.C. has advanced the salary of the tramways engineer, Mr. W. T. ROBSON, by £200 a year.

Mr. J. R. HANTON has resigned his position as station superintendent at the Rawenstall electricity works, Hareholme, and Mr. Wm. Audley Weldon, of the Lancashire Electric Power Co., has been appointed in his place at £250 per annum.

Cleckheaton D.C. has increased the salary of Mr. A. PICKERSGILL, chief electrical engineer, by £62 10s. a year.

Major HERBERT BELL, Hull City electrical engineer, has returned to his duties after four years with the Forces. The Electricity Committee has decided to recommend the City Council to approve of Major Bell visiting the United States in order to investigate and report on the latest electrical developments.

Mr. A. F. KELLETT, of the Bradford Corporation surveyor's department, has been appointed the permanent way superintendent to the Sheffield Corporation tramways.

General.—We have pleasure in giving herewith a portrait of Mr. J. W. BEAUCHAMP, the recently appointed Director of Electrical Development, whose functions will no doubt bring him into contact with very many of our central-station readers, as well as with other branches of the electrical industry. It is "up to" Mr. Beauchamp to develop "electrical development" in this country; he will not find time hang heavy on his hands in that capacity—he will have a hard task to overcome the dead-weight of inertia and gain the

MR. J. W. BEAUCHAMP.

sympathies of his clients, but he can be depended upon to infuse life and energy into the movement of which he has become the motive force, and he has our best wishes for his success.

We are informed that Mr. J. E. EDGECOMBE and Mr. J. W. ELLIOTT, representing the Tungsten Lamp Association, have been added to the Main Committee, and Mr. Edgecombe, Director of the T.L.A., to the Executive Committee, of the Electrical Development Association.

According to the *Times* Professor FREDERICK SODDY, M.A., F.R.S., Professor of Chemistry in the University of Aberdeen, was elected on Tuesday to the new-established second chair of chemistry at Oxford.

Mr. W. ELSDON DEW, chief mechanical and electrical engineer to the Central Mining—Rand Mines group, has accepted the local secretaryship of the Institution of Electrical Engineers.—*S.A. Mining Journal.*

Mr. S. EVANS, A.M.I.E.E., electrical engineer, of Hoylake, has resigned his position of Chief Government Magneto Inspector at the British Westinghouse Electric & Manufacturing Co., Manchester, and started a business with Capt. G. B. Wheeler, as magneto and car lighting specialists in Argyle Street, Birkenhead.

Mr. W. BRAND arrived at Simon's Town, Cape Province, during March to take up the position of electrical engineer to the Admiralty at the Naval Dock Yards.

Mr. T. J. GIBBONS, third-grade clerk in the electrical department at Devonport Dockyard, has been appointed third-grade clerk in the constructive department at Simon's Town Dockyard, Cape Town, the base of the Cape and West African Squadron. Mr. S. W. RICKARD, acting second-grade clerk in the electrical department, Bermuda Dockyard, the base of the West Atlantic Squadron, has been appointed to the electrical department at Devonport Dockyard.

Mr. J. J. WOODS, engineer and manager of Clones, Co. Monaghan, Electric Light & Power Co., has been appointed to a similar position with the Irish Towns Electric Light and Power Co., Belfast.

At a farewell supper and dance organised by the employés, Mr. E. J. WALSH, A.M.I.E.E., who recently resigned his his position as engineer and manager of the Musselburgh Electric Light & Traction Co., Ltd., was presented with a gold watch and chain and Mrs. Walsh with a gold locket and chain. Bailie Anderson, the local director of the company, who presided over an attendance of about 80, expressed the directors' regret at Mr. Walsh's resignation. Mr. Small, station superintendent, Mr. Smalley, traffic superintendent, and Mr. H. C. Babb (Mr. Walsh's successor) also spoke. Mr. Walsh has joined the staff of Messrs. Andrews & Co., of Glasgow, agents in Scotland for the Enfield Cable Co., Brook Motors, Brotherton Tubes, &c.

It is announced that Mr. ARNOLD B. GRIDLEY has resigned his position as Director of Electric Power Supply, but will act temporarily as electrical adviser to the Ministry of Munitions pending the liquidation of electrical contracts and the disposal of outstanding matters under negotiation.

Mr. W. J. JOHN, D.I.C., A.M.I.E.E., has been appointed lecturer in electrical engineering at East London College (University of London). Mr. John was trained at the City and Guilds (Engineering) College, South Kensington, and has since been for 2½ years assistant designer to Messrs. J. H. Holmes & Co., Newcastle-on-Tyne, and afterwards as wireless engineer in the service of the British Admiralty. Latterly he has been experimental and research engineer with Messrs. Allen, West & Co., Ltd., Brighton.

The Honours List.—The New Year Honours List just published contains the following:—

The Hon. T. H. A. E. COCHRANE, who is made a baron, is a director of the Direct U.S. Cable Co., Ltd., and chairman of Thermit, Ltd.

Mr. E. JARDINE, M.P., who is a director of the English Electrical Co., Ltd., and of the Bridgwater & District Electric Supply Co., Ltd., is made a baronet.

Sir J. D. REES, M.P., also made a baronet, is a director of the Kolar Mines Power Station, Ltd.

Mr. G. M. CHAMBERLIN, upon whom the honour of knighthood is conferred, is a director of the Norwich Electric Tramways Co., Ltd.

Prof. RICHARD ARMAN GREGORY, who also becomes a knight, is a member of the Council of the British Association and in other capacities serves the interests of educational science; he was organiser of the British Scientific Products Exhibition. As editor of *Nature* we tender him our congratulations upon this well-merited distinction.

Obituary.—MR. H. THOMAS.—The death occurred recently of Mr. H. THOMAS, for many years chief engineer of Fleetwood & District Electric Light & Power Co.

MR. IMRE KIRALFY.—We regret to record the death which occurred at Brighton on Sunday night, of Mr. Imre Kiralfy, the world-renowned organiser of exhibitions. During the past 20 to 30 years he had played a prominent part in many international exhibitions held in London. The White City and Stadium, opened in 1908, was a scheme of his origination and execution. The Franco-British, Imperial, and the Japan-British exhibitions, held at Shepherd's Bush, were among the more recent of his important undertakings. There is no doubt that had he lived, his interest in such matters would have led him to undertake other exhibitions and festivals suited to after-the-war conditions.

MR. A. D. HUNTER.—We regret to record the death of Mr. Albert Daniel Hunter, which occurred on April 17th, after a short illness. Mr. Hunter entered the service of Siemens Bros. & Co., Ltd., in 1889. At the formation of Siemens Bros. Dynamo Works, Ltd., in 1906, Mr. Hunter was transferred to that company and occupied the position of chief assistant secretary. Upon the death of the then secretary in 1908, Mr. Hunter succeeded to the position. He was 50 years of age.

Will.—Lieut. LEONARD GUSTAV BYNG, who was killed on active service in France in August, 1918, left £166,608 gross. Lieut. Byng, who was a son of the late Mr. Gustav Byng, was a director of the General Electric Co., Ltd.

Mr. W. D. BUTCHER, an ex-president of the Röntgen Society, left £9,225.

NEW COMPANIES REGISTERED.

Armstrong Whitworth Development Co., Ltd. (154,548).—Registered April 17th. Capital, £2,000,000 in £1 shares. To acquire and hold shares, stocks, debentures, debenture stocks, bonds, obligations and securities, and to carry on the business of iron-founders, engineers, manufacturers of implements, tools, and machinery, brassfounders, metal workers, boilermakers, millwrights, machinists, iron and steel converters, smiths, metallurgists, electrical engineers, &c. The subscribers (each with one ord. share) are:—Rear-Admiral C. L. Ottley, 17, Queen's Gate Gardens, S.W.7; J. H. B. Noble, Ardkinglas, Inveraray, barrister; N. W. Smith-Carington, 12, Cheniston Gardens, W., barrister; H. T. McAuliffe, Runnymede, Manor Way, Blackheath, chartered accountant; S. W. A. Noble, Kent House, Knightsbridge, S.W., engineer; Sir Glynn H. West, 47, Great Cumberland Place, W., engineer; J. P. Davison, 169, Burbage Road, Dulwich Village, S.E., secretary. First directors: J. H. B. Noble, S. W. A. Noble, and Sir Glynn H. West. Qualification, 1,000 shares. Remuneration, £250 each per annum (£100 extra for the chairman). Registered office: 9, Great George Street, Westminster.

Boothroyd Repairs, Ltd. (154,461).—Private company. Registered April 17th. Capital, £5,000 in £1 shares. To take over the business of the electrical contracting part of the business of H. T. Boothroyd at Akenside Street, Bootle. The subscribers (each with one share) are:—F. S. Milton, Gorsefield, Queen's Drive, Moseley Hill, Liverpool, pawnbroker; W. H. Thomson, 67, Worcester Road, Bootle, Liverpool, electrical engineer. First directors: F. S. Milton (chairman), H. T. Boothroyd, and W. H. Thomson. Registered office: 25-33, Chaloner Street, Liverpool.

Devon Hydro-Electric & Development Co., Ltd. (154,506).—Private company. Registered April 19th. Capital, £20,000 in £1 shares. To promote an Act for incorporating a statutory company for generating electricity by using water from rivers on Dartmoor or elsewhere in Devon, Somerset, and Cornwall, or otherwise, and supplying electrical current for all purposes, and also for supplying water, &c. The subscribers are:—F. B. Lacy, Claremont, Northwood, company director, 1,000 shares; W. S. Abell, 11, Wedderburn Road, N.W.3, naval architect, 250 shares. First directors: Prof. W. S. Abell, F. B. Lacy, J. N. A. Houblon, P. B. Glanville, and Dr. J. A. Parves. Registered office: 52, Queen Street, Exeter.

J. A. Crabtree & Co., Ltd. (154,486).—Private company. Registered April 17th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electrical and mechanical machinery, dynamos, motors, cables, heaters, cookers, &c. First directors: J. A. Crabtree, 16, Clements Road, South Yardley, Birmingham; G. F. Harper, Branksome, Victoria Park, Colwyn Bay; J. A. Harper, 53, Douglas Road, Acocks Green, Birmingham. Solicitor: H. Cant, 33, Newhall Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Priestman Bros., Ltd.—Particulars of £5,000 debentures, created February 12th, 1917, and all issued March 28th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital, freehold and leasehold land, &c. These debentures rank *pari passu* with £5,000 like debentures issued in 1916, and next after a prior lien debenture for £10,000 issued in 1902, but in priority to £21,250 debenture stock secured by trust deed of 1913.

Thompson Bros. (Blackburn), Ltd.—Particulars of £1,500 debentures, created and all issued March 25th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Omega Lampworks, Ltd.—Issue on February 21st, 1919, of £600 debentures, part of a series already registered.

CITY NOTES.

W. T. Henley's Telegraph Works Co., Ltd.

At the annual meeting, on Friday last, Mr. G. Sutton, M.I.E.E., who presided, said that although the result of the trading for the year under review was not as good as that of the previous twelve months, he believed it would be regarded as very satisfactory by the shareholders. They had increased the share capital by the issue of 200,000 new ordinary shares. The reserve account was reduced by the £200,000 which had been capitalised by the new ordinary shares, but it still remained at the substantial amount of £105,000, which it was proposed to increase at the meeting to £130,000, and in addition they had provided £10,477 for repairs which could not be done during the war. They were still making war allowances to the dependents of men who still remained in the forces. So far they had spent about £16,000 on that account. On the other side of the balance sheet the amount to the credit of land, buildings, and machinery was reduced by the transfer to the new Tyre Co., and, on the other hand, it had been increased by the £19,000 of additions. There had not been much building during the war, but in the current year the amount which would be required for additions would be much larger, as they were proceeding with many building plans. Investments in Government securities were less by about £5,000, as they would be using the money in the development of the business now that restrictions on trading were removed. There was an increase of £140,000 in investments by reason of the partly-paid shares which they held in the new Tyre Co. The item of stock in trade was a little smaller than in the previous accounts. The profit and loss account showed a reduction of about £35,000 in the balance of trading account, but provision for depreciation was about £20,000 less owing to the fact that they had not had to put down as much special machinery for war purposes as in previous years, and consequently they had not had so much to scrap. The net profit amounted to £148,000, or about £14,000 less than last year, but notwithstanding that they were paying an increased dividend. They had considerably increased the salaries paid to the staff, and the wages of the workpeople; they had increased bonuses all round, had added to their reserve account, and increased the carry forward, and that being so, the directors thought that the reduction in the purchasing power of money and the high rate of income tax justified them in recommending an increase in the dividend. During the past 30 years the undivided profits of the business had been used in developments and extensions. The small factory which existed 30 years ago, employing some few score of people, had developed into the three factories now possessed by the company in which they employed some thousands of people. The use in that way of reserves so created was bound to lead to the enlargement of the profits. With regard to profit-sharing as usually understood, he thought it was absolutely impracticable in connection with such a business

as the company carried on. He had given more than 20 years' consideration to the matter, and had endeavoured to find a method which the company could adopt, but without success. He could not find any system which would satisfy the labour side and at the same time would not endanger the existence of the business as a prosperous concern. Was it likely that labour under a profit-sharing scheme would be satisfied that profits should be used in extension of the business? That was only one of the many difficulties which arose in a business such as theirs in dealing with the problem. He was convinced that labour had to be satisfied with being properly paid and not by any division of profits. They were paying 15 per cent. on the ordinary capital, but that was not a proper way of looking at their dividend. The share capital was not the item to look at in considering the profits, but the actual capital which was employed in working the business, and the actual dividend paid on the capital employed in the business was less than 4¼ per cent. They were doing a great deal more for their workpeople than merely paying them wages. They were doing all sorts of work in connection with their welfare departments, in respect of which a considerable charge appeared in the present accounts. As to the future, it was more difficult than usual this year to attempt any reliable forecast. They had quite a large number of peace orders on their books, but they had been hampered since the armistice by restrictions on exports, and to a more moderate extent by restrictions on imports of raw materials. He trusted that those restrictions would be removed in the course of a few weeks. At the present time, however, they were suffering under them, and the works were not as fully occupied with ordinary commercial work as they might otherwise be. The effect of the high wages which they were paying upon the future of the industry and upon their ability to meet competition was difficult to estimate. With his 40 years' experience of the business he might say that there was plenty of work at present for the whole of the electrical industry, and he thought that for the next two or three years the high rate of wages would not interfere with their obtaining business. Certainly as far as the home trade was concerned they would be in no worse position than any of their competitors, and he presumed that the authorities, who taxed them so heavily, would see that they were not unduly hampered in competitive trade in England by foreign competition in the form of dumping. For the next year or two at all events he did not think they would suffer as regarded the overseas trade, but high wages might eventually have a great effect on that trade, though he did not feel competent to make any forecast in that connection. It was impossible to state what the position of America and Japan might be in the next two or three years with regard to labour. The palliative for high wages was supposed to be a larger output, and so it was, but he was not inclined to think that the rearrangement of hours which they had recently made at their factories would give them an increased output to compensate for the increased cost of labour. He believed, however, that the higher rates of wages generally must inevitably lead to a greater demand for commodities which must result in higher prices or in the increase of production. Personally, he was not at all opposed to a high rate of wages. In conclusion, the chairman referred briefly to the tire business, which he said was a splendid enterprise. Its future, however, was endangered by the excess profits duty, because being a new business it had no pre-war standard of profits, and they were only allowed 6 per cent. on the original capital employed and 9 per cent. on the additional capital, which after providing for income tax and other charges, allowed nothing for the development of the business, and did not give a sufficient return to the capital employed, to enable new capital to be raised. Mr. Martin Roberts seconded the motion, and the report was adopted.

Bromley (Kent) Electric Light and Power Co., Ltd.

Mr. F. E. Gripper presided recently at the annual meeting. He said that the adverse conditions had been increasingly felt at Bromley, where their revenue depended so largely upon lighting load. The Rationing Order decreased their lighting sales by 20 per cent., as compared with 1917, and by 40 per cent., as compared with pre-war. Sales for heating and power fell off by 20 per cent., as compared with 1917. Revenue decreased by £2,327, and costs of generation increased by 400. The combined effect of the lighting restrictions and summer-time had resulted in their having to run the works for six months last year at an actual loss, expenses exceeding the receipts during the six summer months, April to September. They not only had to increase the charge per unit, but had to put into force the minimum charge of 13s. 4d. per quarter provided for in their provisional order. The reason that the minimum charge of 13s. 4d. per quarter was provided for under the provisional orders was that capital expenditure had to be incurred by the company for every consumer connected to the company's supply, the cost of connecting a small consumer being very little less than the cost of connecting a large consumer. Unless a minimum of 20 units was taken and paid for each quarter there was not an adequate return upon the expenditure which had had to be incurred in order to make the supply available to the consumer. The consumers who used less than 20 units in any quarter had been supplied at a loss, as the company's standing charges incurred in order to make the supply available to the consumer had to be met whether the consumer was using a supply or not. Objections were taken to the charge on the ground that under the rationing order people were expected to economise, but it should be pointed out that people were not expected to economise below a certain point, and that the ration of electricity allowed for even the smallest house was never less than 20 units for each of the two summer quarters and 40 units for each of the two winter quarters. The company's object in enforcing the minimum charge was not that they wanted the consumer to pay for electricity which he had not used, but they wanted the consumer to use the minimum of 20 units, as it was the revenue which was of importance to the company. The year had been very difficult and trying, and of the future it was difficult to say how quickly to expect a return to normal conditions, but he hoped that the restrictions on lighting would shortly be removed, when a large part of the lighting load would be regained. During the last four years the connections to the mains had increased by nearly 20 per cent., and when in full use again he saw no reason why they should not regain former prosperity.

Dublin & Lucan Electric Railway Co.

The report adopted at the annual meeting showed that after providing for debenture interest, there is a balance of £744, out of which the preference dividend for one half-year is to be paid, absorbing £475. The chairman, Mr. J. W. Hill, said the traffic receipts showed a net increase over 1916 of £3,284, and over 1917 of £2,345, and the receipts from electric light had increased from £362 in 1917 to £432 in 1918, or nearly 20 per cent. During 1918 the passengers carried were 441,171, compared with 452,137 in 1917—a reduction which was entirely due to the limited service, particularly on Sundays, when the service was cut down by 60 per cent. by order of the Government. All the principal expenditure figures showed increases. He hardly exaggerated in saying that the wages bill for 1919 would not be less than double that of any previous year, and the cost of fuel had risen by nearly £1,000, or practically 33 per cent. over 1917. The total increase in expenditure over 1917 might be taken at £3,000. In view of the arrangement with the Government, the present income did not depend on traffic receipts or working expenses. Unfortunately, they could never hope, as long as that arrangement held, to pay a full dividend on the preference shares. In the circumstances, the directors considered it their duty to ascertain the company's legal position with regard to the debenture liability, and counsel had advised that it was not necessary, under existing war legislation, to do anything beyond continuing to pay the interest for the time being. This advice, of course, they would follow.

Madras Electric Tramways (1904), Ltd.—Mr. A. M. Quill, presiding at the annual meeting on April 23rd, referred to the increased working costs and the cost of materials, also to the increase in fares to meet the situation. There was an increase of 9.9 per cent. in the number of passengers carried and of 11.2 per cent. in traffic receipts. It is intended, during the current year, to replace the 60-lb. rails in Wall Tax Road by 90-lb. rails, and this will practically complete the substitution of the old 60-lb. section. The route for a new double line for a certain length had been approved by the corporation, and the matter was before the Government for consideration. The estimated cost of widening of bridges in this connection was to be borne partly by the corporation and the company and partly by the Government. The board was about to proceed, in co-operation with the Madras Electric Supply Corporation, with the institution of a provident and pension fund for the employés.

Indian Electric Supply & Traction Co., Ltd.—The report for 1918 states that the surplus on the year's working in Cawnpore was £19,271 (against £17,767 in 1917), and including transfer fees and exchange adjustment in England the credit side of net revenue account shows a total of £20,674. London expenses £2,227; debenture interest, £3,900; reserve for depreciation and renewals, £6.000; debenture issue expenses written off, £1,000; brought forward, £685. After paying 8 per cent. for the year on the ordinary shares issued prior to December, 1918, and 5½ per cent. on those issued subsequently, £336 is paid as directors' commission on dividends, and £1,171 is to be carried forward.

North of Scotland Electric Light & Power Co., Ltd.—Gross profit for the year ended December 31st last £6,644. Interest on debentures and loans absorbed £2,629, leaving a balance, including £1,700 brought forward, of £5,714. A dividend of 3 per cent. is recommended; £2,000 to be placed to renewal reserve; £1,000 to general reserve; and £1,214 to be carried forward.

New Issue.—*The Manganese, Bronze & Brass Co., Ltd.*, have been issuing (through the British, Foreign & Colonial Corporation, Ltd.) £115,000 first mortgage six per cent. redeemable debentures to provide new capital for the erection of rolling mills at Ipswich, &c.

W. T. Glover & Co., Ltd.—*Year 1918.* Dividend on ordinary shares 5 per cent. and a bonus of 2½ per cent., both less tax. To reserve £20,000. Carried forward £9,891.

Montreal Light & Power Companies.—The Montreal Light, Heat, and Power Consolidated has declared a dividend of 1 per cent. on the paid-up capital stock (being at the rate of 4 per cent. per annum) for quarter ending April 30th. The Montreal Light, Heat & Power Consolidated, operating the above company, has declared a dividend of 2 per cent. on the paid-up capital stock (being at the rate of 8 per cent. per annum) for the same quarter.

Stock Exchange Notices.—The following are to be officially quoted:—

International Light & Power Co., Ltd.—£396,200 5 per cent. first mortgage debentures of £100 each (within Nos. 1 to 4,000).

Newcastle-upon-Tyne Electric Supply Co., Ltd.—500,000 additional ordinary shares of £1 each, fully paid (Nos. 797,682 to 1,297,681).

City Electric Light Co., Ltd. (Brisbane).—Year ended January 31st, 1919. Credit balance £33,559. Interim dividend paid in September £16,839. Further dividend paid in March, 1919, 3 per cent. on preference and 5 per cent. on the ordinary. Carried forward £415.

Dictograph Telephones, Ltd.—Annual meeting held April 14th. Very successful year reported; future prospects very satisfactory. Dividend 10 per cent., less tax.

River Plate Electricity Co., Ltd.—Half-yearly dividend of 3 per cent. on the 6 per cent. non-cumulative preferred shares.

Kaministiquia Power Co.—Dividend 2 per cent., less tax, for the quarter.

STOCKS AND SHARES.

TUESDAY EVENING.

THE Stock Exchange is a-tiptoe with expectation over the Budget. As May 1st is a holiday, markets will not feel the force of the Chancellor's speech until the Friday in this week, but advance forecasts have been many. The income tax and the excess profits duty are the two main centres of interest. Relief in the one case may be balanced by further pressure in the other. Meanwhile the hopes of compromise between the "Big Four," the obvious breaking-up of Bolshevism in Russia, and the coming release of industry from Government control are hailed as bullish factors. Business is by no means bad, although last Sunday's blizzard played havoc with communications for a day or two. The oil boom continues an outstanding feature.

Oil is playing a prominent part in the amazing prosperity of the City Services Co. Gross earnings in 1911 were under a million dollars. In 1916 they were over 10 million dollars, and last year they came to 22 million dollars. Net profits were two million dollars in 1913, and 21¾ million dollars in 1918. The expansion occurred mainly through the company's utility business, but the report mentions a new branch of profit, present and potential, in the oil lands that are being developed. Two years ago, the gross earnings from oil operations were 4¼ million dollars, whereas last year they rose to 18 million dollars. New capital to the tune of 34 million dollars was raised during 1918, and of this, 30 million dollars was in 7 per cent. convertible gold debentures. The common shares stand at 425, the fractions at 350, and the preferred at 84.

Home electricity issues are disposed to be dull, although the pre-ordinary issues remain firmly held. Charing Cross ordinary are ¼ lower, and shares in the other London undertakings lean to the lower side. Edison Swan have gone back to par on the forthcoming issue of 200,000 ordinary shares at £1 each, the money being wanted for development of the business. General Electric ordinary rose 12s. 6d. to 18¼ on the hope of an early scheme for splitting the shares. Electric Constructions are 1/16 easier at 23s. 9d. The new preference shares of the Midland Power Distribution are hard at 5s. premium.

Mexican Utilities have weakened on the disquieting news of further revolution and bloodshed. Mexico Tramways 6 per cent. bonds fell 3 to 49, and business was recorded at 47, while the 5 per cent. first mortgage changed hands as low as 59. British Columbia Electric Railway 4½ per cent. debenture recovered to 62, but the preferred is 2½ lower at 37½. Brazilian Tractions are 1¼ up to 57¼, other Brazilian issues also being in favour.

Marconis remain quiet, notwithstanding the fact that the whole of the business is to be freed from restrictions. Mr. Godfrey Isaacs has been speaking optimistically of the capacity for wireless extension, more particularly in connection with the development of aeroplane services in the sphere of commerce. Marconis are steady at 4 13/16, Marines being better at 4 11/16. Americans fell sharply to 28s. on a slight pressure to sell. Canadians remain at 15s. 9d.

Direct United States Cable shares are flat at 4½, a fall of 15s., on a circular issued by the company recording a chapter of remarkable war accidents. The company's main cable was interrupted as far back as September, 1917, and one drawback after another conspired to prevent the necessary repairs being made. Admiralty requirements, submarine dangers, gales, engine trouble, were amongst the checks encountered. The company spent £70,000 upon fruitless expeditions. On top of all, the Western Union Telegraph Co. decided to enforce the clauses under which it is entitled in certain conditions, first, to reduce the rent, and, secondly, to terminate the lease. The Direct United States Board have taken steps to apply to the High Court for relief against forfeiture of the lease. Arrangements have been made for the immediate dispatch of the C.S. *Faraday* to repair the main cable. There the matter stands for the moment, but a more unhappy concatenation of adverse circumstances can hardly have befallen any cable company as a result of the war.

Anglo-American Telegraphs, meanwhile, are better. Cuba Submarines have risen another 5s. on the dividend, and Eastern Telegraph stock is half a point higher. Telegraph Constructions are 10s. up. Henley's maintain their advance. India-Rubber shares keep dull, although it is held by some that the continued shrinkage in the price of the raw material should be a good thing for such companies. Rubber shares are undecided; the market looks for benefit from the substitution of any form of taxation in place of excess profits duty. The engineering shares keep fairly hard, but Babcocks are ½ down. Armaments are a good market, on the close alliances being formed for peace purposes with electrical industries. The air is charged with rumours of arrangements, absorptions and amalgamations.

Home Rails are heavy, though Metropolitans rose superior to the prevailing weakness and advanced to 27. The London Electric Railway is applying for Parliamentary powers to raise more capital, in the shape of debenture stock. Recent activity in East Londons has given way to the more usual condition of complete quietude. There is a thousand or two 5 per cent. 1914 preference stock of the Metropolitan Railway in the market. It is offered at 77, at which the yield is the exceptionally high return, for a Trustee security, of 6½ per cent. on the money.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price April 29, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	6½	—	£5 8 15
Charing Cross Ordinary	4	4	22	–¼	5 18 4
do. do. do. 4½ Pref.	4½	4½	8½	—	5 18 4
Chelsea	5	5	9	—	4 1 1
City of London	8	8	11½	—	6 16 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10¼	—	6 16 3
do. do. 6 per cent. Pref.	6	6	9¾	—	6 3 1
Kensington Ordinary	7	6	9¾	—	5 2 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	5	6	8¼	—	7 14 10
Metropolitan	4	5	8¾	—	5 0 0
do. 4½ per cent. Pref.	4½	4½	8½	—	5 18 6
St. James' and Pall Mall	9	10	28½	—	7 0 4
South London	5	5	9¾	—	7 5 6
South Metropolitan Pref.	7	7	20/8	—	6 16 7
Westminster Ordinary	9	8	6¼	—	6 3 1
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. T l. Pref.	6	6	96¼xd	+1	6 1 10
do. Def.	1½	22/6	22½	+½	7 9 0
Chile Telephone	8	8	7¾	—	5 3 6
Cuba Sub. Ord.	7	7	11½	+½	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	162½	+½	*4 18 6
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10¼	—	5 14 3
Great Northern Tel.	22	22	31	—	7 2 0
Indo-European	13	13	17½	—	5 13 6
Marconi	20	20	4½	—	4 3 0
Oriental Telephone Ord.	10	15	2-⅛	—	6 3 8
United R. Plate Tel.	8	8	7¼	—	*5 1 7
West India and Panama	1/3	1/3	1¼	—	*4 8 4
Western Telegraph	8	8	16½	—	*4 15 10
HOME RAILS.					
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan	1	1½	27	+½	4 12 7
do. District	Nil	Nil	23½	—	Nil
Underground Electric Ordinary	Nil	Nil	8¾	—	Nil
do. do. "A"	Nil	Nil	9/8	—	Nil
do. do. Income	4	5	66	—	*5 4 2
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 11 4
Anglo-Arg. Trams. First Pref.	5¼	Nil	8¾	—	—
do. do. 2nd Pref.	—	—	3¾	–½	—
do. do. 5 Deb.	5	5	69¾	—	7 8 5
Brazil Tractions	—	—	57¼	+1¼	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Ptcs.	5	5	59	—	8 10 6
do. do. Preferred	Nil	Nil	37½	–2¼	Nil
do. do. Deferred	Nil	Nil	37½	—	Nil
do. do. Deb.	4½	4½	62	+1	6 17 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds	Nil	Nil	49	–3	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	68	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	33	–½	4 2 9
British Aluminium Ord.	10	10	1½	—	6 0 10
British Insulated Ord.	25	12½	2-⅛	—	6 1 1
British Westinghouse Pref.	7½	7½	2¼	—	6 5 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5¾	—	6 3 10
Castner-Kellner	25	20	8½	—	6 3 1
Edison-Swan, "A"	—	—	1	–⅛	7 10 0
do. do. 5 per cent. Deb.	4	5	76¼	—	6 12 8
Electric Construction	10	10	1-⅛	–⅛	8 8 6
Gen. Elec. Pref.	6	6½	10¾	—	6 0 4
do. Ord.	10	10	18¾	+½	*5 8 0
Henley	25	25	2-⅛	—	5 2 6
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	15½	—	*6 0 4
Siemens Ord.	—	10	6¾	—	*7 11 0
Telegraph Con.	20	20	24½	+½	4 16 2

Dividends paid free of Income Tax.

THE LITERATURE OF SCIENTIFIC MANAGEMENT.

By FRANK J. MAURICE.

Before the war, in the United Kingdom, there were probably not more than a hundred manufacturing employers who had heard of scientific management, nor a dozen who knew what it meant; only one had adopted it.

To-day there is a rush for information about it, and a growing realisation that competition will be impossible against American, French, Belgian, Italian, and German industries which produce three articles per workman against our one.

The situation is not an old one that we have survived in the past, but an almost entirely new one, owing to the extension of scientific management, in the countries mentioned, during the war.

The books on the subject are beginning to multiply, and at the request of the editor, the writer proposes to give an outline of the scope of those books which have come under his notice, for the assistance of intending students.

1. *The Principles of Scientific Management.* (By Frederick Winslow Taylor, M.E., Sc.D. Publishers: Harper & Bros., New York.)—In this book—which is essentially the first to read—Dr. Taylor deals with the fundamentals and principles of the subject. The whole philosophy of scientific management is to be found here, together with a number of illuminating examples showing the results the author obtained in leading engineering works in the United States.

The work is a short one—70 pages—the style and subject matter fascinating, and it has for one of its principal objects—to quote the author—to answer the questions: "(1) Wherein do the principles of scientific management differ essentially from those of ordinary management? (2) Why are better results attained under scientific management than under the other types? (3) Is not the most important problem that of getting the right man at the head of the company? And if you have the right man cannot the choice of the type of management be safely left to him?"

2. *Shop Management.* (By F. W. Taylor, M.E., Sc.D. Publishers: Harper & Bros., New York, 1912.)—This book should certainly be next read by a student of the subject. It deals fully with the practical application of the principles of scientific management, but without too much detail, and contains nothing too technical for, shall we say, the non-scientifically trained directors of an engineering concern.

Dr. Taylor does much straight talking to both employer and workman, and while "soldiering"—or ca' canny—is not spared, the still too prevalent notion that low wages mean a low labour cost is equally exploded; and both parties are cautioned at the outset "that no system or scheme of management should be considered which does not in the long run give satisfaction to both employer and employé, which does not make it apparent that their best interests are mutual, and which does not bring about such thorough and hearty co-operation that they can pull together instead of apart."

"High wages and a low labour cost," is the watchword throughout, and Dr. Taylor assures us that this ideal has been attained in every case where he has installed his system, to the mutual and entire satisfaction of both parties.

Profit sharing is not favoured, and some convincing arguments are produced against it. Various pay systems are dealt with and compared.

The author—as a sound manager must be—is a practical psychologist: "The spending of money for good machinery appeals to them (*i.e.*, company directors), because they can see machines after they are bought; but putting money into anything so invisible, intangible, and, to the average man, so indefinite, as an organisation seems almost like throwing it away." But he quotes an enlightened manufacturer: "If I had to choose now between abandoning my present organisation and burning down all of my plants which have cost me millions, I should choose the latter. My plants could be rebuilt in a short while with borrowed money, but I could hardly replace my organisation in a generation."

The ordinary form of management wherein orders are conveyed through several intermediaries from manager to workman is condemned, and "functional management" is insisted upon, the specialists in each function being either united in a planning department, or, at any rate, pivoting thereon. This department is described at some length, and is the centre of the new organisation.

The basis of scientific management, accurate time study, is dealt with at length in a general way, but precise instructions for carrying it out are not within the scope of the book. The general application of time study is described, however, and useful tables for recording observations are included.

In Dr. Taylor's own words: "This book is written mainly with the object of advocating high wages and low labour cost as the foundation of the best management, of pointing out the general principles which render it possible to maintain these conditions even under the most trying circumstances, and of indicating the various steps which the writer thinks should be taken in changing from a poor system to a better type of management."

3. *Efficiency Methods.* An Introduction to Scientific Management. (By M. McKillop, M.A., and A. D. McKillop, B.Sc. Eng., C.E. Publishers: George Routledge & Sons, Ltd., London, 1917.)—Students of the subject, whether "lay" or technical, would do well to make this the third book of their course, though it could easily be read first, and, indeed, should be, if difficulty is experienced in obtaining Taylor's books.

"Efficiency Methods" is undoubtedly the English primer of scientific management. It deals with the whole subject in a methodical and readable manner, and is characterised throughout by unusual impartiality in the comparison of different, and sometimes conflicting, views.

The list of contents is, in itself, an example of efficiency methods, and is worth quoting *in extenso* as an indication of the scope of the book:—

1. Introduction.
2. Management: A Preliminary Discussion.
3. Modifications in Organisation.—A. The Planning Dept.
4. Modifications in Organisation.—B. The Costing Dept.
5. Modifications in Organisation.—C. The Foreman.
6. Standardisation and Classification.
7. Standardisation of Equipment.—A. The Stores Dept.
8. Standardisation of Equipment.—B. The Tool Room.
9. Standardisation of Methods.—A. Time Study and Motion Study.
10. Standardisation of Methods.—B. Fatigue Study.
11. Standardisation of Methods.—C. The Schedule Time or Standard Task.
12. Standardisation of Methods.—D. The Instruction Card.
13. Remuneration under Scientific Management.
14. Scientific Management and Welfare Work.
15. Scientific Management and Trade Unions.
16. Scientific Management and Education.
17. The Installation of Efficiency Methods.

The purpose of this article would not be fulfilled without naming the books (others than those reviewed) mentioned by Messrs. McKillop, and to which the student may wish to refer:—

H. B. Drury's "History and Criticism of Scientific Management," 1915.
R. F. Hoxie's "Scientific Management and Labour," 1916.
H. L. Gantt's "Work, Wages, and Profits" and "Industrial Leadership."

H. L. Gantt's "How Scientific Management is Applied."
A. H. Church's "Proper Distribution of Expense Burden."
Holden Evans's "Cost-keeping and Scientific Management."
Miss Goldmark's "Fatigue and Efficiency."
Muensterberg's "Psychology and Industrial Efficiency."
British Association Committee's Reports on Industrial Fatigue, 1915 and 1916.
Ministry of Munitions' Report on Health and Fatigue of Munition Workers, 1917.
Mrs. L. M. Gilbreth's "Psychology of Management."
Parkhurst's "Applied Methods of Scientific Management."

4. *Motion Study. A method for increasing the efficiency of the workman.* (By Frank B. Gilbreth. Publishers: Constable & Co., Ltd., London, 1911.)—This would appear to be the first book to be read on its special subject. It is the philosophy of motion study, and for every tenet, an example is produced in demonstration, generally taken from the craft of bricklaying. The broad headings dealt with are: (i.) General outline of motion study. (ii.) Variables of the worker. (iii.) Variables of the surroundings. (iv.) Variables of the motion. (v.) Past, present, and future of motion study. The book is profusely illustrated, and serves the double purpose of being a general introduction to the subject, and a particular treatise on bricklaying.

We could have wished, however, that the publishers had read on page 51, "There shall not be any polished surfaces . . . that will reflect an unnecessary bright spot anywhere that can be seen by the eyes of the worker." The book is printed on highly glazed paper.

5. *Applied Motion Study.* (By Frank B. Gilbreth and L. M. Gilbreth, Ph.D. Publishers: G. Routledge & Sons, Ltd., London, 1919.)—This book contains a great deal more than its name suggests. It deals with the whole question of scientific management in a detailed and technical way, and is one of the professional handbooks which the scientific manager himself will use.

Motion study is described in its application to various fields of activity, and the methods and principles of its application to any and all work are dealt with at length. The instruments of the time study engineer are described and their uses explained; they vary from the homely "movie" camera to the somewhat awe-inspiring autostereochronocyclegraph.

The book contains some interesting figures and diagrams, amongst which should be mentioned that illustrating the difference between the traditional or military type of management and functional or scientific management.

The first and last three chapters deal more generally with the subject of scientific management, but are still rather for the technician than the administrator.

6. *Fatigue Study.* (By Frank B. Gilbreth & L. M. Gilbreth, Ph.D. Publishers: George Routledge and Sons, Ltd., London, 1916.)—"Fatigue Study," say the authors, "is related to motion study in that both are branches of waste elimination. Fatigue study classifies fatigue, and outlines methods by which unnecessary fatigue may be eliminated and rest from necessary fatigue may be provided."

The authors advocate a "fatigue survey" in every works, the object of which is to:—

(*a*) Learn accurately the existing "fatigue" conditions.

(*b*) Picture the problem thoroughly to those interested.

(*c*) Analyse the problem of fatigue elimination into working units susceptible of attack.

(*d*) Arouse the interest of all employés.

(*e*) Show relation between fatigue and activity.

(*f*) Teach every worker to conserve his working powers.

A very readable treatise, primarily for the technical manager, but of almost equal interest to employer and welfare worker.

7. *Taylor System in Franklin Management.* (By Lieut.-Col. George D. Babcock, formerly production manager, H. H. Franklin Manufacturing Co., in collaboration with Reginald Trautschold, M.E., with a foreword by C. G. Barth. Publishers: G. Routledge & Sons, Ltd., London, 1918.)—For many reasons this is a wonderful book, and not least among those reasons are the enthusiasm and public spirit which prompted the Franklin Co. to have such intimate information as to its inferior economy published to the world. For this book describes in detail and graphically the working conditions and results of the company's automobile production over a term of nine years ending in 1917, covering periods before, during, and after the installation of the Taylor system.

It is essentially the advanced technical handbook on our subject, and should be read by any management before their consulting management expert commences to install the new system.

It is interesting to note the somewhat exceptional circumstance that the installation of the Taylor system was invited by the works management of the Franklin plant, rather than by the owners; an impartiality and progressive spirit on the part of the former which the directorate of an industrial company will not be wise in expecting to be often repeated—at least for some years to come, when sufficient object lessons and the effects of competition have done their work. The author faithfully relates how the Taylor system was investigated by himself and his co-workers, and describes the evidence upon which they recommended its adoption to their management. He then deals with the installing of the system in all its details, including some quite special "mechanism" such as a control-board room where exact progress throughout the plant was indicated on a number of control boards bearing numeral and symbol type, and a pneumatic tube system for sending and receiving job tickets between individual workmen and the planning department. These tubes convey some thousands of job tickets, &c., per day.

The text is adequately and graphically illustrated with figures and charts, and the enumeration of a *few* of these will give a slight indication of the scope and value of the book: Fig. 1, classification of clutch assembly (illustrating mnemonic system of identifying parts, &c.) Fig. 2, classification of materials. Fig. 6, photograph of arrangement of a tool storeroom. Fig. 10, details on control board, showing rear axle operations. Figs. 11 & 12, forms; analytical record of time and earnings of a workman, and analysis of same man's rating. Fig. 14, front and reverse of inspector's report of spoiled and defective material for a workman. Figs. 15 to 20, various forms as to rating, &c. Fig. 21, organisation classification table; a synoptic chart of the organisation under functions and duties. Chart i, production in cars and numbers of workmen over whole period of nine years. Chart iii, production time (descending curve) and hourly rate of pay (ascending curve). Chart iv, production cost of car (descending curve). As will be seen, many diagrams have had to be excluded on considerations of space.

Appendix I deals with wage rates and the necessarily elaborate method of their calculation having regard to all the factors involved. Appendix II provides details of the application of scientific management to (*a*) repair shop, (*b*) small parts factory, (*c*) plant with uniform manufacture.

8. *Scientific Management. A collection of the more significant articles describing the Taylor system of management.* (Edited by C. Bertrand Thompson, LL.B., A.M., lecturer on manufacturing in Harvard University. London publishers: Humphrey Milford, Oxford University Press, 1914.)—It is not proposed to attempt a review of this volume, which comprises 50-odd papers running to nearly 900 pages, and including a valuable bibliography of the subject which alone covers 16 pages, and which

should prove of inestimable value to the student. Needless to say, this bibliography is classified under headings and subheadings dealing with every aspect of the subject.

9. *The Science of Labour and Its Organisation.* (By Dr. Josefa Ioteyko. Publishers: G. Routledge & Sons, Ltd., London, 1919.)—The title of Dr. Ioteyko's work is a little misleading. It is really a medico-pedagogic treatise—to borrow his own expression. The author was formerly head of the laboratory of psycho-physiology at Brussels University, and this book deals with the subject of scientific management from his own special standpoint. It is a valuable handbook for the scientist taking a passing interest in scientific management rather than for the efficiency engineer in his practical work, though it forms a useful introduction to fatigue study for the latter.

The footnote references form a useful index to much literature on the subject in the French language, and the chapters on education, ambidexterity, anthropometric comparison of the sexes, &c., will be valuable to many.

10. *The Human Motor and the Scientific Foundations of Labour.* (By Jules Amar, D.Sc., Director, Laboratory of Research in Professional Labour, National Conservatory of Arts and Crafts, Paris; preface by Prof. H. Le Chatelier, Inspector-General of Mines. Publishers: G. Routledge & Sons, Ltd., London, 1919.)—This book is still at press, and by courtesy of the publishers the present writer has seen proofs of the opening chapters of Mr. E. Butterworth's translation.

It is a prodigious work, as may be realised from the fact that the mechanics of the body are dealt with in a detailed, complete, and scientific manner. The early part of the book is primarily adapted for university use, for the teacher rather than for the practitioner, but we understand that later chapters describe fully the application of human mechanics to a considerable number of different trades.

11. *Wealth from Waste.* (By Henry J. Spooner, C.E., F.G.S. Publishers: G. Routledge & Sons, Ltd., London, 1918.)—Mr. Spooner's book deserves mention as being an encyclopædia of "waste," and should be on everyone's reference bookshelf. Every sort and kind of waste is dealt with from the absence of a domestic stockpot and the ash from one's cigar, to land erosion and inefficient factory organisation. The last-named, however, is our subject and the two chapters dealing with it, while interesting to the general student of waste, may be safely ignored by the student of scientific management.

The author appears to draw his information on the subject exclusively from the Gilbreths, and their writings must be studied at first hand. One wishes Mr. Spooner had found time to give some attention to the works of Taylor, who, after all, was the founder of the science, and whose principles stand intact to-day, even when his details of application may be modified, as he himself saw they would be.

12. *The Question of Scientific Management.* (By James Richardson, B.Sc. Published by the Institution of Engineers and Shipbuilders in Scotland.)—This pamphlet comprises a paper read by the author and the subsequent discussion. The paper deals with the whole subject—functional foremanship excepted—in a concise and convincing form, and the nature of the discussion prompts one to feel that the subject will have practical developments in Scotland—both in the shop and in the University—in the very near future.

Like most experts, Mr. Richardson points out that, "generally the works with the highest actual charges due to managerial efficiency produce most cheaply."

THE FULLERPHONE AND ITS APPLICATION TO MILITARY AND CIVIL TELEGRAPHY.

By Major A. C. FULLER, R.E., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

By passing through an ordinary telephone receiver a current interrupted at a suitable frequency, a note at the frequency of the interrupter will be heard in the telephone, and audible signals consisting of long and short notes will be heard if the key is manipulated in accordance with the Morse code, in the telegraph system shown in fig. 1, p. 516. An exceedingly minute current arriving at B will give an audible signal.

The minimum current capable of producing an audible sound in a telephone receiver is certainly not more than 0.0000005 ampere. No other telegraph instrument equally robust will indicate the received signal (wire telegraphy is here referred to) so positively with so small a current.

Such a system is not employed in the form shown, and is certainly not so good as the vibrator system. The latter, however, has certain very serious disadvantages. The line is traversed by vibratory currents of relatively high voltage, which induce similar currents in other lines in their proximity; hence the number of possible lines on one route is limited, owing to the interference between them. By the use of suitable apparatus these vibrating signals can be read at immense distances from the line, and hence any messages can be overheard. The use of vibrators in any area effectually jams in that area friendly listening-sets which might otherwise overhear enemy messages, and it is manifestly impossible to superpose the vibrator system on telephone lines.

In order to produce something more suitable than the vibratory system, it was necessary to provide on the line a direct current as in ordinary single-current Morse, but of as low a value as possible—at the same time converting the energy thus transmitted into vibrating or pulsating current at the distant end; further, such vibrating currents had to be closely confined to the distant end and prevented from surging back along the line.

Fig. 2 is essentially the circuit adopted. K_1, K_2, K_3 are condensers each of 1 microfarad. CH_1, CH_2 are choke coils of large impedance, each about 2.4 henries and 750 ohms resistance. The chopper is an electrically-driven vibrating interrupter fitted with two contacts, one of which is used to drive it, the other to interrupt. The chopper can be adjusted to any frequency between 300 and 600 or 700.

The receiving circuit is shown in fig. 2. Now, if a steady electromotive force is applied between the line and earth, and the circuit is closed at X, a steady current will flow through the choke coils, contact 2, and receiver. If the circuit is broken at X, the current cannot flow through the receiver, but will flow into and charge the condensers. When the circuit is again closed at X the condensers partially discharge through the receiver R.

When the interrupter X is working we therefore get an intermittent current in the telephone receiver, giving an audible note, while (if the choke coils and condensers are suitable) the line current alternately flows through the receiver and into the condensers, and remains practically constant and continuous in the line. The result is that the dots and dashes sent by the single-current Morse key at the far end are received as short or long notes in the telephone receiver at the receiving end, while the current in the line is of much the same nature as that sent by an ordinary single-current Morse set, except that it is very much smaller, as readable signals can be obtained with about ¼ milliampere. In practice a main battery of one dry cell is used.

The signals are much clearer than those from the "buzzer," as the commencement and end of a signal do not depend on the starting and stopping of a vibrating armature; hence the rate of working is higher than with a buzzer.

The arrangement of choking coils and condensers not only prevents any appreciable variation in the line current, but also prevents any vibrating currents (such as are produced by induction from other circuits, by a buzzer on the line, or from a telephone) from passing through the operator's head telephones. All such currents pass through the condenser K_1. Should any vibrating current make its way through CH_1 it will then take the path to earth through K_2 rather than through the high inductance CH_2; thus the telephones are doubly protected from induced currents or from telephone currents passing over the same line.

When the sending battery is connected as shown in fig. 3, the current can only rise in the line comparatively slowly, owing to the effect of the capacity of the condensers and the self-induction of the choke coils. The object of this retardation of the rise of current is to prevent clicks being heard in a telephone receiver inserted in the line. This has a two-fold object: To prevent the possibility of Morse messages being read from these clicks; and to prevent the clicks interfering with telephony carried on over the line simultaneously with Morse signalling.

The Fullerphone is not a polarised instrument, and the direction of the received current does not affect the signals. The arrangement of chokes and condensers acts also in the other direction, thus ensuring that the vibrating currents in the circuit K, 2 R are confined to this circuit and cannot surge back into the line.

It is apparent that a telephone can be added on the same line without any interference between the Fullerphone and the telephone as far as speech is concerned, and in the latest Army instrument a telephone has been incorporated, in series with the Fullerphone. The Fullerphone may be superposed over telephone pairs in the usual way.

Where Fullerphone and Morse are employed in the same telegraph office, or on the same pole route, a leakage current from a single-current Morse set will cause the signal from such set to be heard in the Fullerphone receiver when the interrupter is running. A similar current from a double-current set or duplex will give confused signals. In either case they may be strong enough to interfere with the Fullerphone signals.

If such currents leak on to the Fullerphone circuit at a contact on the line, the only thing is to clear the contact. Such leakage, however, frequently occurs at the office, owing to leakage either at the test board or at the earths.

The same earth should not be used for both Fullerphone and Morse circuits, or interference is almost certain to result. The best earth obtainable should be used for the Morse, and an inferior earth used for the Fullerphone. The earths should be as far apart as possible and the wires leading to them should be kept clear. A bad earth will not be disadvantageous for the Fullerphone proper, unless very bad indeed, but the speaking (if such is required) may suffer. If there are Morse and Fullerphone instruments in the same office the circuits and their earths should be kept entirely separate.

FIG. 1.—I, INTERRUPTER; R, RECEIVER; L, LINE.

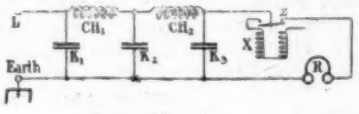


FIG. 2.

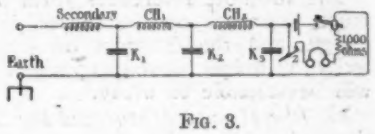


FIG. 3.

For the Army instruments for field use an arrangement has been made to send a strong buzzing current to the line for purposes of calling attention. The interrupter buzzer is used for this purpose, and its ordinary battery is reinforced by two additional cells, making three in all.

The buzzing call can be relied on in normal conditions, but if the circuit is very bad it may be possible to call and send messages on the Fullerphone when the buzzing call will not get through.

Disturbance due to Earth Currents or Leakage.—Difficulties in working the Fullerphone are almost invariably due to small currents being picked up by the line either by the earths, by earth faults, or by leakage from Morse circuits. The currents to cause this disturbance must be of a steady nature, or of a very low frequency. The effect of the steady current is to produce a note in the Fullerphone receiver of exactly the same pitch as the receiver signals, which are thereby confused and may be rendered unreadable. This disturbance can only be noticed when the local buzzer is running.

An earth current on the line causes a continuous hum in the Fullerphone receiver when the local interrupter is running. If the earth current is in the opposite direction to the signalling current sent out by the sending station, the signal received when the sending key is depressed will be that due to the difference between the sending and earth currents, while the sound when the key is not depressed will be that due to the earth current only. Hence, if the received earth current is half the received signalling current, the current will be altered in direction but not in magnitude when the sending key is depressed, and no signals at all will be received. If the earth current is greater than half the signalling current the signals will be actually reversed. If the currents are equal there will be silence at the receiving end when the key is depressed at the sending end.

If, on the other hand, the currents be in the same direction, the signalling current will always increase the earth current, and the signals will always give a louder note than the earth current alone. Hence the disturbance due to steady earth currents in a direction opposite to that of the signalling current can always be reduced (in most cases sufficiently to work the line) by reversing line and earth at the sending and, thus bringing both currents in the same direction. If the earth current gives a loud note the signalling can be improved by increasing the resistance of the circuit, which is most easily done by increasing the resistance of the earth. A good earth is not required for the Fullerphone, and may even be a disadvantage.

The disturbance from a steady earth current either from a leak or from the earths can always be eliminated by the insertion of a potentiometer in the line at the receiving end, and such a potentiometer forms a component part of the service instrument. The potentiometer consists of a length of high-resistance conductor through which flows a current from one cell. One end of this conductor is connected to one terminal of the potentiometer, and a sliding contact (which can be adjusted to make contact with any portion of the conductor) is connected to the other. The potentiometer is connected in series in the line and impresses a portion of the electromotive force of the cell on the line. If the electromotive force thus impressed on the line is equal and opposite to that producing the earth current, the earth current and its disturbances are eliminated.

Each station must adjust its own potentiometer to suit the earth currents received by it. As the currents are frequently picked up at earth faults, they will not necessarily be the same at each end of the line.

It must be remembered that the Fullerphone is very sensitive, and one 1,000th part of the current usually employed in Morse working will give strong signals in the Fullerphone.

Fig. 4 shows the circuits of the latest pattern Army field set. This instrument provides for telegraphy and telephony either independently or simultaneously on the one line without further apparatus. When the receiving buzzer is not working, the buzzing call from a distant station is heard both in the head receivers and in the hand set—or if the hand set is not plugged in, only in the head receivers. When "Fullerphoning," the Morse signals are heard in the head receivers only. When speaking and telegraphing, the speech is heard in the hand set and the Morse signals in the head receivers.

In order to show clearly the operation of the various circuits fig. 4 is dissected into its elements in fig. 5. When

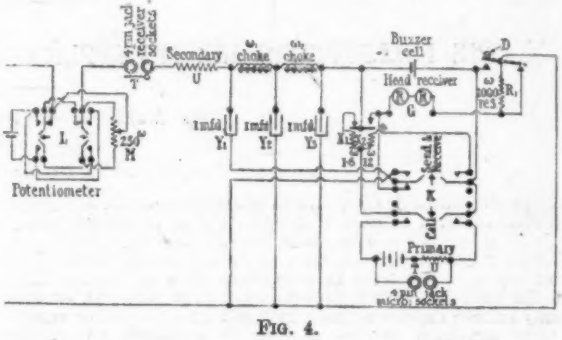


FIG. 4.

the 4-pin plug is inserted the line is completed through the receiver of the hand set. When the plug is withdrawn the receiver sockets are short-circuited by a spring contact.

The fact that no sound is heard in a telephone receiver inserted in the line shows that the system is non-inductive. Fig. 6, which is a reproduction of oscillograms kindly made by the Research Department of the G.P.O., affords further proof. The gradual and slow rise of current shown in fig. 6, and referred to earlier, accounts for the fact that not even clicks are heard in the line.

Exhaustive tests have been made to ascertain whether the system—using a single wire and earth return—is safe from the possibility of being overheard by enemy listening-sets. It was found that under ideal conditions for the listening-set, and using the best listening-set that we could devise for the special purpose, the messages were safe from overhearing at a distance of 100 yards from the line. These ideal conditions would never obtain in practice in the field.

The minimum current required to operate for legible signals was less than ¼ micro-ampere. Hence the system will work over lines of immense conductivity resistance and very poor insulation. In practice we have often worked earthy lines of which the conductivity resistance was far greater than the total insulation resistance. Before the system was adopted for the Army the author had the privilege of testing it over some specially selected lines in Flanders in 1915. The lines were selected chiefly on account of their unpleasant location and necessarily bad condition,

where the ground was waterlogged and pitted with shell holes, and maintenance was anything but easy.

It seems that, provided the line is not actually broken, it can be worked by Fullerphone almost irrespective of its general conditions.

From experiments and trials recently made it has been established that the Fullerphone can replace Morse sounder

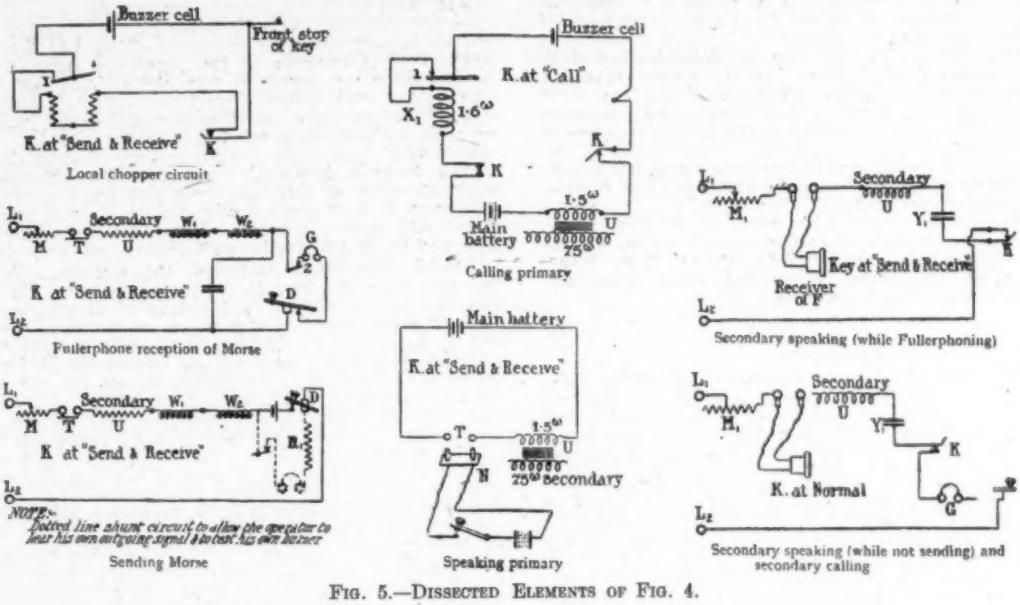


FIG. 5.—DISSECTED ELEMENTS OF FIG. 4.

sets on any hand-worked line. The advantages to be expected include the following:—

1. Great saving of battery power.
2. Simplicity of office wiring and manipulation of instruments.
3. Very long distances can be covered without translation or relaying.
4. Maintenance of lines can be reduced to a minimum.
5. Lines may be of very high resistance.
6. Lines may be very leaky and contacts with foliage, &c., are of slight importance.
7. No disturbance whatever is caused to neighbouring or parallel telephone circuits, and no disturbance need be feared to telephone circuits when Fullerphone is superposed.
8. It will be possible to work long stretches of land line and then cable and land line again without any conversion or re-transmission.

In order to be applicable to civilian uses the instrument is altered from that already described. In the first place, the

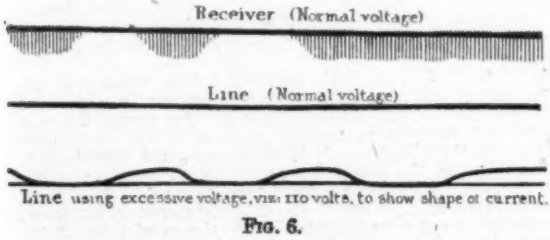


FIG. 6.

buzzer call is objectionable and is discarded. A method of direct-current calling has therefore been devised, and this is satisfactory.

The main relay which receives the direct-current call is an enclosed moving-coil instrument and is very sensitive. It is provided with a shunt (variable) so that its sensibility can easily be controlled. The relay is a slow action one, and is therefore very suited for responding to a calling dash. A second or local relay is very small, and is used in order to handle the current actuating the calling buzzer (or bell), which would be prejudicial to the prolonged satisfactory working of the main relay.

A call is sent out by pressing a push-button, which puts a small 3-cell "Ever-ready" battery in series with the working battery, thus sending a current of short duration from a battery of about 7 volts to operate the distant relay. The act of calling also tests the home apparatus for receiving a call. The local calling buzzer should operate when the push-button is pressed. This arrangement will work well through very long and very bad lines. When attention has been obtained the work is carried out by Fullerphone proper. The main relay is capable of reliable action with a current of the order of 10 micro-amperes, and will respond through a resistance of 700,000 ohms.

A further addition is a switch to enable the chopping for any number of sets to be done by one multiple chopper independent of the sets. The author has constructed multiple choppers to deal with 6 and 10 circuits each, which are driven by a 4-volt accumulator and only require a very small current—about 150 milliamperes.

Using such a system, one small 4-volt accumulator is sufficient to work the whole office. It drives the buzzer, and so effects the chopping, and it also provides the minute signalling currents for all the lines.

The instrument can be arranged for duplex working on the bridge method; this method is very suitable, and the usual objection to bridge duplex—namely, the increased battery power required—does not hold, owing to the extreme sensibility of the receiving system.

The system is admirably suited for exchange working. It makes little difference to the signal whether the line over which it is transmitted is 100 miles, say, longer or shorter; hence the present necessity for re-transmission at intermediate stations is removed and direct-through plugging can be employed.

By the use of auxiliary apparatus the system can be used quite satisfactorily where recording work at relatively high speeds is required. By means of a relay of special design invented by Capt. L. B. Turner, R.E., and modified for high-speed work, the aural signal received can be readily made to operate an ordinary telegraph relay at high speed,

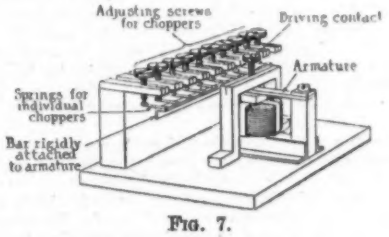


FIG. 7.

hence direct-printing systems such as the Creed can be employed.

In the same way the signals received can, after amplification, be uprighted and made to give beautiful records on a siphon or other recording device.

The author has not yet had an opportunity of ascertaining to what extent the system can be advantageously applied to cable practice, but with our present knowledge of amplifiers and the possibilities opened up by experience with the 3-electrode valve, great advances in submarine telegraphy are assured. The normal audible signal produced by the method is admirably suited for operating on the grid of an amplifying valve. The telephones are, for this purpose, replaced by the primary winding of a suitable transformer—the secondary winding being connected to the grid-filament of the valve.

To sum up, the present position is that for military work the Fullerphone has practically superseded the vibrating system formerly employed. It is now being tried for working long lines in back areas, where is will almost certainly replace all hand-worked Morse-sounder sets. It appears, therefore, that, as far as line telegraphy is considered, the Fullerphone system will be used throughout, except—for the present, at any rate—for those lines normally working high-

speed Wheatstone. These Fullerphones will be of two patterns—the trench Fullerphone, which is weatherproof and well protected, for the forward area, and the office pattern further in the rear. For civilian use, one cannot expect sounder sets that are established and giving satisfaction over well-constructed routes to be discarded in favour of Fullerphones; but it is expected that the advantages to be derived from the new system will lead to its adoption in countries not already thoroughly developed from a telegraphic standpoint. An opening should also arise in tropical countries where maintenance difficulties are considerable—and it is probably not too much to say that the system described would give satisfaction wherever difficulties from any cause render Morse-sounder working precarious. For cable work the author feels—with due deference to certain experienced submarine telegraph engineers—that an investigation of the possibilities of a system combining Fullerphone, amplifiers, special existing relays, and recording and printing devices, would prove very profitable.

The author acknowledges with gratitude the help which he has received at various times from several brother officers—notably, Lieut.-Col. Evans, C.M.G., D.S.O., R.E., Major E. O. Henrici, R.E., Major Purves, and others, whose suggestions have proved very valuable.

Discussion.

Mr. W. Judd, in opening the discussion, recalled the early days of telegraphy, and mentioned experiments that had been carried out and the results that were achieved. The system described by the author had already been worked out many years ago by, he thought, an engineer in the Netherlands. The system had been used, but was discarded on account of the difficulties that were encountered. The splitting up of messages received at the end of a line so that they became audible in a telephone had also been done before. Nevertheless much credit was due to the author for the development of his apparatus and its use at the front, where it had rendered very useful service. He had had an opportunity of seeing much of the apparatus in the course of a works visit, and had been extremely interested in all he saw and what he had been told about it. He could not say much with regard to land lines, but with long submarine cables he thought the inverse-current system would have to be used. Concerning amplifying valves, he could not really say that he knew very much about them. They had tried to obtain valves with which to experiment, but that had not been possible during the war, as every valve that was made was required for Government use. However, they would be grateful for any help that such valves could afford them.

Lieut.-Col. Evans, C.M.G., D.S.O., R.E., explained that there was a good deal of prejudice against the Fullerphone when it was first used at the Front, and to some extent it still existed to-day. That prejudice had arisen chiefly because they had too many different types of instruments when the system was first introduced. At that time it was common to find a different type of instrument at each end of the same line, and leakage current difficulties further contributed their share to the raising of prejudice. With unskilled operators, any instrument that gave no trouble and required little understanding, was always popular, whereas anything that was new and required a little more careful thought and handling would have to overcome many prejudices. Since its first introduction they had learned much about the Fullerphone and its good qualities, and although he could not say they were yet in a position to dispense with the buzzer and sounder methods altogether, they hoped before very long to get the Fullerphone adopted as the standard Army instrument.

Mr. Harrison pointed out that French patents dated some years back specified very similar apparatus to that which the author had described. His methods, however, differed from the French ones chiefly in two points, one of which was the manner in which messages were filtered. Personally he could not say that he shared the author's sanguine hopes concerning the application of the Fullerphone to ordinary civil work. The chief objections to its use for such purposes were that the instrument was hand operated, and it would be difficult to obtain anything like good balances. Further, the system was subject to disturbances from outside, for instance, the instruments would become hopelessly jammed by the influence of tramways or electric railways in the vicinity.

Mr. Brown explained that he had himself invented, years ago, apparatus very similar indeed to that described in the paper, and slides were thrown on the screen illustrating the device. The apparatus was submitted to the cable companies, and was successfully used to maintain communication over broken Atlantic cables. It was also submitted to the Government, but was evidently not wanted at that time. There was no doubt that the author's device was very sensitive indeed, and, in his opinion, efforts should be made towards directionalising, which would lead up to the radiotelephone exchange, a much needed want.

Mr. H. Nash explained that by the aid of amplifiers the Germans could overhear what was going on in the British lines; acting on intercepted messages in this way they were able to cause much damage and loss of life. The range over which telephone messages could be overheard in this manner was something like two or three miles, and he did not think it was realised how intolerable the position really became. When is was known what the enemy was doing, he and others set to work to see if the state of affairs could not be altered or the conditions reversed. It was found by experiment that if a buzzer current was sent along the line in front, so to speak, of the message to be protected, a screening effect was produced, and such a jumble of noises and interfering frequencies introduced, that anyone attempting to intercept the message was completely baffled. Although that was not quite what was wanted it was a good beginning, and had lead up to very much better results. They had listened to a good deal of criticism of the paper, for some of which perhaps there was room. It was also claimed that similar apparatus or methods had already been invented many years ago. If the conditions were known or anticipated, why could not someone have come forward with the remedy? In his opinion very great credit was due to the author for the work he had done; he had really done something. Results were produced which at that time were very badly needed, and they were of very great service indeed. As a result the author had been the means of saving a large number of lives, and for that alone, he, as a civilian, was very grateful.

General Hildebrand corrected the statement that the Germans were the first to intercept messages. He stated that two French officers by the help of 75 mm. cartridge cases as earths, and ordinary telephone receivers, were the first to do so. In his opinion, there were grounds for the prejudice that existed in the Army against the Fullerphone. On its first introduction the apparatus was difficult to use, requiring constant adjustment. If a heavy fault occurred near the sending end the message would not reach its destination. Some credit was due to the Australian Corps, who appointed inspectors, and eventually kept the system in working order. In the early part of the war he had the privilege of providing facilities for the author to test his apparatus on certain lines in the Ypres sector, and the results obtained were satisfactory. The lines on which the instruments were tested were in an extremely bad condition.

Mr. Wilson, speaking with regard to sounder *versus* buzzer systems, thought the former was very much to be preferred. Concerning the advantages claimed for the application of the Fullerphone to civil telegraphy, he said that there were certainly some advantages in its favour. The saving in battery power, however, was more apparent than real, and he thought the case for simplicity of office wiring had not been made good. He was in entire agreement with the author in saying that "the system described would give satisfaction wherever difficulties from any cause rendered Morse sounder working precarious."

Other speakers pointed out that an R.E. officer at Chatham in 1880 made some experiments on the lines described in the paper, and messages were sent over 15 miles of wire laid along hedges and on the ground. The author was congratulated on having applied the principle and achieved definite results, although perhaps the principle might not be new. The telegraph was out of date, and would be superseded by the telephone. A disadvantage of the Fullerphone was that it required expert operators. A telegraph exchange was very complicated, and if it could, by means of some such system as that described, be operated on the lines of a telephone exchange it would become a much more simple matter. Doubt was expressed as to whether the Fullerphone system would work on long, high-speed lines such as London to Glasgow where 120, or London to Birmingham, where 180 words per minute, printed, each way, were handled on the duplex system.

Major A. C. Fuller, R.E., replying briefly to some of the points raised, said that although various suggestions had been made concerning the nomenclature of the device he considered it a compliment that all speakers continued to refer to it as the "Fullerphone." Most speakers had taken a very narrow view of the use of his apparatus. He did not advocate its adoption in large cities where efficient systems were already at work, but there were other places not so fortunate. Concerning the doubts expressed as to the capabilities of the system, he had not set about the thing in a light-hearted manner, he had been working at it for well over three years, and the paper set forth his considered opinion. Other apparatus, which was not his invention, he was not in a position to speak about, but much could be achieved in conjunction with it. If some speakers could obtain possession of all the facts relative to the subject, he thought they would very greatly modify some of the statements that had been made.

Faraday House Scholarships.—On the results of examinations held for entrance scholarships at Faraday House the following awards have been made:—

"Faraday" Scholarship (fifty guineas per annum for three years), R. A. Emerson.

"Maxwell" Scholarship (fifty guineas per annum for two years), D. E. Bird.

The following entrance exhibition and prizes have also been awarded:—

To J. P. H. Read, entrance exhibition (twenty-five guineas per annum for two years).

To M. W. Foulkes-Roberts, entrance prize (twenty-five guineas).

To S. J. Bausor, entrance prize (twenty guineas).

JAPAN'S ELECTRICAL PROGRESS.

During last year the capital invested in electrical industries in Japan increased by over £6,000,000. According to a report by the Department of Communications, this increase has been helped by the general industrial expansion which took place in Japan during the period of the war.

In light and power plant, £36,737,750 had been invested by the end of 1918, £4,358,680 in electric tramways, and £33,199,650 in plant both for supplying power and light and operating tramways. The total amount of capital invested amounted to £74,296,070, this figure being a gain of £6,432,145 over the close of 1917. The investment in this comparatively new line is, says the official report, bigger than that in mining, which stood at £23,928,000 at the end of last year. It even threatens to rival the investment in railways, which is £109,670,000.

The Americans are very much alive to this development, and have been actively investigating the Japanese market with a view to ascertaining in what lines of electrical manufacture there is still a good opening for sales. As a result, a bulletin has been issued by the Bureau of Foreign and Domestic Commerce in the United States, which, it may be added, also deals with prospective sales in China and Vladivostok.

So great is the demand for telephone installations in Japan, that when a subscriber is willing to give up his telephone he sells it through a broker, there being a regular market value of from £50 to £150.

There are now nearly 700 central-station systems in Japan, 530 electric power and light systems, 42 electric tramways, and 48 combined railway and lighting systems, together with 1,609 private, and 53 Government-owned plant.

In 1915 there were 3,051,925 families using electric light, and in the fall of 1917, there were 152,000 subscribers awaiting the installation of telephone apparatus, some of them having waited for more than 10 years. In December of that year there were to be some installations made from among the 4,000 "urgency applications," but only 300 of them were made, and some of these not until the March following.

In recent years Japan has changed from an exclusively importing country to an exporting one, and has established its own electrical goods industry. It is now a strong competitor in some lines in its own markets, instead of being solely a consumer of imported goods.

Heretofore American manufacturers have sold the largest percentage of generators, switchboards and switchgear. While switchboards and switchgear are turned out by Japanese works, they have not made the progress in these lines generally that they have in the apparatus lines. Americans are hopeful of being able to sell higher-voltage equipment, and considerable numbers of the instrument and relay requirements for the boards that are made up locally.

Japanese engineers follow American transmission and distribution practice quite closely. Line construction, switching stations, and sub-station arrangements are generally similar to those employed in the United States, except in a few instances. It is estimated that there is about 20,000 miles of extra high-pressure lines in operation.

The United States, Germany, and the United Kingdom have until the last few years furnished most of the requirements in motors and controlling devices, but since 1913 Japanese motors have been coming into the market more and more. While there are a few fair Japanese motors, it is not believed that they will give such continuous satisfaction as a Western-made machine.

The import figures for ammeters and voltmeters show American goods leading strongly. Schools and central stations have bought high-class American testing instruments to a fair extent.

In wattmeters the United States has had a good trade for some years. American alternating-current meters in normal times cost more than foreign makes, but at present they are meeting foreign prices closely.

There is some small opportunity for the sale of higher-class American wiring supplies, such as flush push switches, receptacles, fancy shades, semi-indirect lighting units, &c., for use in new modern-type buildings.

There is not much opportunity for arc lamps. Street lighting is the greatest field for that kind of lamp, and in Japan there are not many wide streets so that the demands in this line are limited. The incandescent lamp is more suitable for the average narrow-street lighting conditions, where low candle-power units are all that are required.

One class of goods that will probably find a market in Japan for a time are those that are used in connection with electric signs. The Japanese appear to be taking up electric signs to an increasing extent, and appreciate the use of electricity for advertising purposes. It is believed that patented types of sign sockets, flashers, &c., will find an increasing sale. Fittings for outline lighting should have a small sale also, and some flood lighting was seen in operation.

As regards China, says the report, there were imported in 1916 electrical goods to the amount of approximately £800,000. This, in connection with the fact that the Chinese people have developed a progressive tendency, and the great population and increasing purchasing power, indicates an important future demand for electrical goods.

REVIEWS.

Physics for Technical Students, Parts IV, V, and VI. Sound, Light, Electricity, and Magnetism. By W. B. Anderson, Ph.D. London: Hill Publishing Co., Ltd. Pp. xiii + 458; 220 figs. Price $2.00 net.

It is seldom that we find an American text book with so essentially English a flavour as obtains with the volume under review. This is the second volume of Prof. Anderson's physics for technical students, and contains the sections on sound, light, and electricity and magnetism; it is intended later to bind up both volumes in one for use in first courses in college physics. In scope and size the whole treatise will closely resemble Watson's Physics, so well known in English colleges and technical schools, and the resemblance also extends to the type and diagrams.

Part IV—Sound—comprises 55 pages, and includes excellent chapters on the production and transmission of sound, characteristics of musical sounds, musical instruments, and the relations of musical sounds. The treatment of all these subjects is largely descriptive, but half a dozen numerical examples at the end of each chapter serve to give a quantitative basis to such parts of the work as can be thus illustrated, *e.g.*, the velocity of sound, the Döppler effect and beats.

Part V—Light—occupies over 150 pages, and gives a very complete account of the chief optical phenomena—reflection, refraction, dispersion, interference, diffraction, radiation and absorption, colour, and polarisation. Both the physical and geometrical aspects are represented, and, what is so important in this subject, good diagrams have been drawn. In many cases the wave front method of treatment has been adopted. Although the author has compressed many important subjects into very brief paragraphs, *e.g.*, the rainbow, defects of the eye, and the diffraction grating, we cannot find any serious omissions, while the chapters on radiation and polarisation are splendid examples of how the more advanced portions of physical optics can be brought within the understanding of comparatively elementary students. The former of these chapters is illustrated by some good spectrum photographs.

Part VI—Electricity and Magnetism. This section occupies the last 200 pages of the book. It commences with a very short but comprehensive chapter on magnetism followed by a more detailed account of electrostatics. The treatment of current electricity follows the usual lines, but here as in the other sections of the book, the author shows an unusual capacity for giving a maximum amount of information in a minimum of words. The information given is accurate, well arranged and remarkably up-to-date. The Weston cell is given rather less than its fair share of attention, and we should have expected to hear more of the Edison storage cell than is given in a five-line paragraph. But on the whole there is very little to which exception can be taken. Paragraphs are given to such recent and important developments as electric welding, electric furnaces, and nitrogen-filled lamps, and in many other matters there is ample evidence that the author is abreast of modern electrical developments.

The examples appended to the chapters on current, voltage, and resistance, heat, light, and power, and electromagnetic induction are well suited to test the student's grasp of the text.

An outline of the principles of dynamo-electrical machines is given in chapter 41, and we notice with satisfaction that the author has avoided the common practice of dragging in armature winding puzzles at the earliest possible opportunity. This is a matter which can conveniently be treated *after* the student has discovered what a dynamo is and how it works.

The concluding chapters on electrical discharge through gases and electromagnetic waves are excellent introductions to these two great branches of physics. Here again the treatment is up-to-date, and radio-telephony, Fleming valves, and determination of e and m all find a place as well as the classical experiments upon which these subjects have been built up.

On the whole Mr. Anderson's book has impressed us most favourably. There is throughout a conciseness and clarity of statement which could scarcely be surpassed. Here and there we may have expected a somewhat fuller treatment, but on the other hand, there is an exceptional air of completeness which disarms criticism. We have seldom seen such a complete treatise on physics in so few pages.—P.H.S.K.

The Practical Telephone Handbook and Guide to the Telephonic Exchange. By J. Poole, A.M.I.E.E., Wh. Sc. Pp. xxiii + 725; 585 figs. Price 12s. 6d. net. London: Sir Isaac Pitman & Sons, Ltd.

This popular handbook on telephony has now reached its sixth edition—a result which not only bears evidence of a demand for it by technical students, but likewise indicates that the author appreciates the necessity, if the book is to be referred to at all, of keeping pace with the rapid developments which have taken place within the past few years in telephony generally.

The present edition has been largely rewritten in order to bring the work more into line with the telephone engineering practice of the British Post Office, and the author has availed himself of the co-operation of Post Office engineering experts

in the revision, or rewriting of those chapters which deal with their special functions. The need has also been recognised of cutting out old matter to make room for descriptions of important modern changes.

The book in its general get-up is much the same as in previous editions, beginning with the inevitable introductory chapter, which is supposed, in the space of 27 pages, to equip the student with a knowledge of electricity and magnetism sufficient to the understanding of what follows.

In Chapter II, which deals with primary and secondary cells, it is satisfactory to note that the results of the experiments carried out by the Post Office which led to the general use of powdered manganese dioxide and carbon in place of the old granular form, have been incorporated.

A short chapter on historical matter is followed by two others dealing with the types of receivers and transmitters which are now in general use.

Sub-station apparatus, intercommunication systems, switchboard apparatus, &c., follow in much the same order as in the earlier editions, and hence need but a passing reference.

The new chapters which have been added include those dealing with private branch exchanges, central battery signalling systems, multiplex telephony, transmission, telephone repeaters, and military telephones.

The two first mentioned deal exhaustively with their subjects; but in the case of multiplex telephony it is thought the high frequency system as exemplified by Squier's method might have been amplified to advantage.

The chapter on telephone repeaters gives in very brief outline the principle of repetition by means of the bulb relay which is now being successfully employed on several of our English telephone lines, and there is no doubt that the success which has attended the experimental installations justifies the hope that we are on the eve of great developments in this direction so far as interurban lines are concerned, but to this the author makes no allusion.

The final chapter of the book is devoted to what is known as the "Relay Automatic Telephone Co.'s System," and the process of establishing a connection between one subscriber and another is, with the aid of suitable diagrams, fully described. The *Electrical Review* on February 7th referred to this system as "an epoch-making advance in automatic telephony." The marvellous record of reliability established by it in connection with the State telephone system at Stockholm justified the opinion then expressed as to its inherent excellence.

Of the miscellaneous matter added to the book it is satisfactory to note that a description and diagram are given of Hay's Bridge for inductance measurements, to which, however, there is no reference in the index.

Messrs. Pitman have produced an excellent work both in the letterpress itself and the relative diagrams, which appears to be very free from typographical errors. We have no doubt this latest edition will meet with an equal success to that of its predecessors.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

9,281. "Dynamo-electric machines." P. H. H. Jantzen & Siemens Bros. Dynamo Works. April 11th.

9,294. "Electrical gear for operating bulkhead doors, &c." H. H. Bentley and Harland & Wolff. April 11th.

9,297. "Time-limit overload electric relays." R. Brooks & British Westinghouse Electric & Manufacturing Co. April 11th.

9,316. "Wireless receiving and transmitting apparatus." J. Erskine-Murray & J. C. Robinson. April 11th.

9,323. "Electric connectors and plugs and sockets." C. L. Arnold and C. R. Belling. April 12th.

9,325. "Electric cables." F. Harris. April 12th.

9,340. "Device for tramcar trolley poles." J. H. Beaby. April 12th.

9,364. "Electromagnetic wave navigational systems." M. Jeance. April 12th.

9,367. "Apparatus for electric telegraphs, &c." W. Greaves & E. Lawton. April 12th.

9,385. "Electrically-operated apparatus." C. Melano (Bagutti). April 12th.

9,388. "Means for adjusting carbons in electric arc lamps." J. Minsky. April 12th.

9,411. "Impulse sending device." Automatic Telephone Manufacturing Co. (Automatic Telephone Manufacturing Co., U.S.A.) April 14th.

9,443. "Electric signalling and indicating apparatus." McKenzie, Holland & Westinghouse Power Signal Co. & H. M. Proud. April 14th.

9,453. "Dynamo-electric machines." A. A. Price. April 14th.

9,477. "Electric heating apparatus." E. B. Miller. April 14th.

9,483. "Electrodes for electric welding." A. le Chatelier. April 14th.

9,488. "Induction coils." Lodge Fume Deposit Co., L. Lodge & Sir O. Lodge. April 14th.

9,489. "Electrical deposition of particles from gases." Lodge Fume Deposit Co., L. Lodge & Sir O. Lodge. April 14th.

9,492. "Production of aluminium nitrids, &c., by electrically-generated heat." E. C. R. Marks (Armour Fertiliser Works, U.S.A.). April 14th.

9,511. "Electric heating resistance elements." L. V. Leonard. April 14th.

9,536. "Electro-mechanical propulsion and control of submersible vessels, &c." N. H. Wood. April 15th.

9,583. "Electric batteries." G. W. Roberts. April 15th.

9,603. "Transmitting selected sounds." J. L. Spence. April 15th. (U.S.A., May 2nd, 1918.)

9,624. "Brush for electrical work." W. W. Coote. April 15th.

9,638. "Ignition control of engines using inflammable vapours for motive power." J. I. Hall. April 15th.

9,654. "Wireless transmission apparatus." R. Whiddington. April 15th.

9,657. "Locking devices for electric lamp globes." E. Smith. April 16th.

9,667. "Locking devices for electric lamp globes." E. Smith. April 16th.

9,671. "Electrically-operated valves for control of steam, gas, air, liquids, &c." G. Wilkinson. April 16th.

9,676. "Electric switches." J. H. Collins & M. J. Railing. April 16th.

9,677. "Electric foot appliances." A. Rickards. April 16th.

9,704. "Electric arc lamps." P. Freedman. April 16th.

9,741. "Galvanometers, &c." W. H. Apthorpe & Cambridge Scientific Instrument Co. April 16th.

9,780. "Electric lamp and light fittings." D. Assersohn. April 16th.

9,787. "Electric heating rings or stoves." J. A. Colquhoun. April 17th.

9,799. "Sparking plugs for internal-combustion engines." F. W. Baker. April 17th.

9,800. "Electric relays." L. B. Turner. April 17th.

9,822. "Carbon-holders for arc lamps for kinematographs, &c." F. A. Thomassin. April 17th.

9,829. "Harnessing tidal energy for generating electricity, &c." M. Snee. April 17th.

9,837. "Rotary electric converters." British Westinghouse Electric and Manufacturing Co. April 17th. (U.S.A., June 17th, 1918.)

9,865. "Incandescent lamps, &c., and manufacture of same." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 17th.

9,873. "Terminal for clamping electric leads." J. C. Hutton & Spensers, Ltd. April 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

112. Apparatus for the detection and measurement of gases. G. A. Shakespeare. January 4th, 1916. (124,453.)

177. Arc lamps. G. Westercamp. January 5th, 1916. (124,455.)

1,310. Flash signalling apparatus. A. W. Sharman. January 27th, 1916. (124,485.)

1,827. Winding reels for use in wireless telegraphy installations on aircraft. C. L. V. Lee. February 7th, 1916. (124,498.)

2,066. Wireless telegraphy with undamped oscillations. E. R. Clarke. February 11th, 1916. (124,499.)

2,120. Submarine signal sound-receiving apparatus. S. M. Davison. February 12th, 1916. (124,500.)

2,201. Systems for distributing electric energy. C. H. Wordingham. February 14th, 1916. (124,502.)

2,339. Telegraphy and apparatus therefor. A. C. Fuller. February 16th, 1916. (124,504.)

2,402. Signalling by electromagnetic waves. A. Arton. February 17th, 1916. (124,506.)

1918.

5,202. Telephone receivers. J. W. Hobley. March 25th, 1918. (124,561.)

5,421. Interlocking mechanism particularly applicable to electric switches. V. G. Middleton & C. J. Baker. March 27th, 1918. (124,577.)

5,476. Telephone systems. Automatic Telephone Manufacturing Co., J. Savin & A. J. Ray March 28th, 1918. (Addition to 1,970/14.) (124,581.)

5,477. Telephone systems. Automatic Telephone Manufacturing Co., J. Savin & A. J. Ray. March 28th, 1918. (Addition to 1,970/14.) (124,581.)

5,478. Telephone systems. Automatic Telephone Manufacturing Co. & A. J. Ray. March 28th, 1918. (124,583.)

6,021. Electro massaging apparatus. H. Ashton. April 9th, 1918. (124,598.)

6,981. Electric starter for internal-combustion engines. G. Questa and Officine Electro-Meccaniche. April 25th, 1918. (124,614.)

7,164. Electromagnetic brakes, clutches, ratchets, and the like. E. C. Villiers. April 29th, 1918. (124,618.)

7,619. Electrical apparatus for controlling the curtains and lights in connection with the projecting screen or proscenium of a kinematograph or other theatre, or for like purposes. C. E. Falconbridge & J. W. Lewsley. May 7th, 1918. (124,622.)

8,639. Electro induction apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 24th, 1918. (124,631.)

8,669. Telegraphic relays. J. S. Withers (K. C. Cox). September 18th, 1916. (Divided application on 13,251/16.) (124,632.)

9,959. Electric ignition apparatus. Akt. Ges. Brown, Boveri et Cie. June 16th, 1917. (117,447.)

1919.

6,527. Interlocking mechanism for combined switches and plug-and-socket connectors. V. G. Middleton & C. J. Baker. March 27th, 1919. (Divided application on 5,421/18.) (124,703.)

12,188. Cores for pupin loading coil magnets. Western Electric Co. (Western Electric Co., U.S.A.) July 26th, 1918. (124,658.)

12,470. Control of dynamo-electric machinery. J. C. Wilson. July 31st, 1918. (Addition to 115,786.) (124,659.)

14,163. Safety gaps of ignition magnetos for internal-combustion engines. E. A. Watson & M-L. Magneto Syndicate. August 31st, 1918. (124,665.)

15,434. Automatic telephone systems. Automatic Telephone Manufacturing Co. February 4th, 1918. (123,053.)

London Electrical Strike Averted.—On Wednesday of last week, said the *Evening Standard* of last Friday, the South Metropolitan Electric Light & Power Co. discharged Mr. A. Dominay, a shop steward and member of the Electrical Trades Union. It was alleged that he was discharged for slackness of work, but the men observe that he had been ten years in the employ of the company, and that he is a prominent trade unionist. Dominay was discharged at 1½ hours' notice. The matter was taken up by the union, but the feeling among the men was so strong that, had no settlement been arrived at meanwhile, spontaneous action would have been taken by them, and the whole of them would have been out at 3 o'clock on Thursday afternoon. Just in time to avert a stoppage an agreement was arrived at, under which the company agreed to pay Mr. Dominay his usual weekly earnings until such time as the Joint Council set up between the employers and the union has determined whether Mr. Dominay shall be reinstated.